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The Impact of Outsourcing on Efficiency in Rural and Nonrural School Districts: The Case of Pupil Transportation in Minnesota

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Abstract Government finance reforms in the United States have encouraged public entities to focus on their core mission and to use outsourcing to improve efficiency, yet little is known about whether these reforms impact rural areas differently than nonrural areas. This paper analyzes the provision of one service that is provided either in-house by school districts or outsourced—pupil transportation—and presents a variable cost function for pupil transportation for individual districts in the state of Minnesota. In-house provision of transportation was not shown to be more costly than outsourcing in either rural or nonrural locations; however, small rural districts were much more likely to provide pupil transportation in-house than other types of districts. Large contractors may seek the most profitable contracts in urban and suburban areas, while showing little interest in contracting opportunities in rural school districts.

1. Introduction

The debate over how government services are provided is shifting from ideological discussions to empirical analyses of the political, economic, and community factors that affect whether a service is provided in-house or outsourced (Herfetz and Warner 2004). The outsourcing of services by the public sector is sometimes seen as a way to increase competition, improve service, and reduce costs; but little is known about whether outsourcing impacts rural areas differently than nonrural areas. In the United States school districts are units of government that often outsource a variety of non-core functions (e.g., food services, custodial services, pupil transportation, etc.) (Finkel 1998). The rationale for outsourcing suggests that school districts may have a tendency to provide such services in an inefficient manner due to the lack of competition and the bureaucratic nature of government agencies. The resulting competition is supposed to provide an incentive for firms to operate in an efficient manner (Lavery 1999).

This paper presents a variable cost function for one service provided by school districts—pupil transportation—for individual districts in the state of Minnesota. School districts typically either operate the pupil transportation system in-house or outsource the service to a private contractor. The estimated function was used to analyze whether private contractors or school districts provided pupil transportation services more efficiently in rural and nonrural school districts during the 1999-2000 school year. School finance reforms in Minnesota (and in many other states) during the 1990s encouraged school districts to outsource pupil transportation as a way to reduce costs and at the same time permit school districts to "refocus their attention on educating the young people in their classrooms" (Finkel 1998, p. 40).

Large contractors may be more interested in bidding on bus contracts in some geographic settings than

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in other settings. Rural school districts face unique management issues related to pupil transportation that occur due to the dispersed nature of the population in rural locational settings. Buses in rural areas often have very long routes and each bus may only be used for one run whereas in urban and suburban school districts, each bus is generally used for multiple daily runs. Rural districts are also often smaller and school district personnel may assume a variety of duties. For example, in a small rural district the superintendent may manage pupil transportation operations while a larger district would employ a director of pupil transportation (Alspaugh 1996). If differences are found in the manner in which transportation is provided between rural and nonrural school districts, there may be a role for policy to develop regulatory mechanisms that will assist school districts in providing efficient pupil transportation services no matter where the district is located. The paper is organized into five major sections: (1) Background information; (2) Previous studies; (3) Methods; (4) Results; and (5) Discussion.

The student transportation industry is the largest single carrier of passengers in the United States. During the 1998-99 school year, $12 billion of public funds were spent to transport 23 million students over 3.8 billion miles on 448,000 buses (School Transportation 2002). Expenditures for transportation represented 6.1 percent of the nation's education budget (U.S. Department of Education 2002). Bluth (1999) even asserts that the yellow school bus has replaced the apple as the symbol of American education.

The public provision of student transportation has grown from a small part of the school budget in the early 1900s when most children walked to school, into a major program today with more than 24 million students riding the bus each day (U.S. Department of Education 2004). During the 1919-20 school year, only 1.7 percent of the students were transported to school at public expense (Bryans 1986); during the 1999-2000 school year, 57 percent rode the bus. Using constant 2000-01 dollars, the average annual per pupil expenditure for student transportation has increased from $237 per student in 1960 to $575 in 2000 (U.S. Department of Education 2004).

The funding and organization of pupil transportation services in the United States has historically been intertwined with many other social and economic issues, such as school consolidation and school desegregation, that extend far beyond just physically moving children from one location to another. During some time periods, contractors provided most pupil transportation services while during other periods many districts provided the service in-house.

In the early years, horses pulled a school wagon that was often called the school hack. Almost all student transportation was privately contracted because "it was much more practical to pay a farmer in the neighborhood than to build a barn for the horses and hire someone to care for them" (Bryans 1986, p. 20). As specialized motorized vehicles became the norm during the 1930's, there was a trend away from private ownership of buses to district ownership. By 1935 one-third of pupil transportation services were provided in-house by school districts (Bryans 1986). Featherston and Culp (1965) identified three reasons for this change: 1) to provide pupil transportation more efficiently; 2) to gain control of student transportation to improve quality; and 3) to make pupil transportation an integral part of the school program. In 1980, more than 70 percent of pupil transportation services were provided in-house (Bryans 1986).

Policymakers and school districts are still seeking to improve the efficiency of pupil transportation operations and in recent years more districts across the United States are again using contractors. During the 1999-2000 school year, contractors transported almost 43 percents of students in the U.S., but it varied greatly between states. For example, in Pennsylvania contractors owned 77 percent of the buses in 1999-2000; but, in Indiana only 23 percent of buses were owned by contractors (School Transportation 2002).

School bus contractors tend to be either very large firms or very small firms. Some rural districts even today retain the tradition of hiring farmers or housewives, each owning one bus, to provide pupil transportation services (Ross 1988). A recent trend, however, is that many contractors are now very large corporations. Laidlaw, Inc., currently the largest carrier in the United States, transported 900,000 students each day in 1993; by 2002, the firm was transporting more than 1.9 million pupils per day. First Student, Inc., the second largest carrier, transported 1 million pupils per day in 2002—in 1993, its predecessor Ryder had transported only 450,000 students per day (Lazarus 2004).

Every firm makes production and pricing decisions about what to produce, how to produce it, and for whom to produce the good. The decisions that any given firm makes are affected by its expectations about how other firms will react to those decisions. Firms operate under three different market structure scenarios (e.g., pure competition, monopoly, and oligopoly). The conduct and performance of a firm differs depending upon the market structure of an industry. When there is imperfect competition, firms operate at the level that does not maximize economic efficiency—though there may be trade-offs between market power and efficiency. The pupil transportation industry may be characterized by elements of oligopoly. When an oligopoly exists, the market activities of one seller have sufficient market power to cause repercussions for other firms. Each firm is dependent upon the actions of other rival firms in the industry, but is uncertain about what actions rival firms will take and therefore develops strategies to respond to the actions of rivals (Scherer and Ross 1990).

The theory of market behavior of oligopolistic firms suggests that when a few firms dominate an industry there may be barriers to entry, collusion, and retaliation. Such barriers may raise market prices in an oligopolistic market compared to those that occur in a perfectly competitive market; and, therefore economic efficiency may not be maximized (Scherer and Ross 1990). The theory can be used to explain the social welfare implications if bus contractors alter their bidding and operating practices as a result of the industry structure.

Six previous studies were identified that analyzed whether contractors or school districts provided pupil transportation services more efficiently, but the results were inconclusive and only one of those studies analyzed whether pupil transportation services were provided differently in rural and nonrural settings. As shown in Table 1, four studies (Bails 1979; McGuire and van Cott 1984; Ross 1988; Hutchinson and Pratt 1999) concluded that private contractors were more efficient, while two other studies (Harding 1990; Alspaugh 1996) found in-house provision more efficient. Three of the studies (McGuire and van Cott 1984; Ross 1988; Harding 1990) used data from Indiana for the 1979-80 school year. Bails (1979), the earliest of the reviewed studies, used county-level data for five states. All of the other studies used district-level data for one state.

The previous studies have framed the issues related to whether pupil transportation services were provided more efficiently in-house or by a contractor in very different ways depending upon the era when the study was conducted. For example, one of the explanatory variables that Bails (1979)—who conducted research during a time period when there was intense debate about the pros and cons of using busing as a policy tool to desegregate schools—included was the percentage of the population that was non-white.

Alspaugh (1996) was the only study that included a variable for geographic setting in the model. Alspaugh used a dummy variable which indicated whether or not buses in a district made "multiple runs" as a proxy variable for ruralness since "multiple routing tends to be employed in urban areas where there are many attendance centers and a larger number of pupils to be transported" (p. 193). Four of the studies (e.g., Bails 1979; Ross 1988; Harding 1990; Hutchinson and Pratt 1999) pooled rural and nonrural data by running a single regression to estimate costs. If the parameters differed across settings, the pooling of data would bias the estimates. If intercepts or slopes differed across groups, serious estimation problems may occur if the parameters were not estimated separately for rural and nonrural districts.

Accounting reports may erroneously show that school districts provided pupil transportation services more efficiently than contractors if they included different costs. School district accounting practices generally only attribute direct variable costs to the pupil transportation enterprise, while a private contractor's bid price to provide pupil transportation services to school districts implicitly includes not only the direct variable costs, but also ownership costs of capital assets such as buses and bus maintenance facilities (U.S. Department of Education 1995)[2]. A necessary condition for good estimates of ownership costs are data that can be used to make solid estimates that accurately reflect the magnitude and timing of all the various costs. As indicated in Table 1, all of the studies reviewed did not account for some or all of the differences in overhead costs. Bails (1979) and Alspaugh (1996) provided no indication that they adjusted their data sets to account for overhead cost accounting differences between school districts and private contractors. McGuire and van Cott (1984), Ross (1988), Harding (1990), and Hutchinson and Pratt (1999) did account for some overhead costs, but focused primarily on bus depreciation. None of the previous studies adjusted the data to reflect the impact of ownership costs associated with a bus maintenance facility.

Most of the previous studies (e.g., Bails 1979; Ross 1988; Harding 1990; McGuire and van Cott 1984; Alspaugh 1996) used data gathered prior to the school finance reforms of the 1990s that encouraged districts to outsource; and, none of the studies analyzed what effect market structure might have on the efficiency of pupil transportation operations in different types of locational settings. New studies of the efficacy of outsourcing pupil transportation are needed due to the inconsistent results of the previous studies. The new studies should accurately estimate operating and capital costs, control for geographic differences that may

[2] In June 1999, the Governmental Accounting Standards Board issued Statement 34 (GASB 34) that created new financial reporting requirements for all levels of government, including school districts. School districts are now required to include an assessment of the value of their physical assets in their financial reports (Governmental Accounting Standards Board 2005). School districts had not begun to implement this requirement at the time this study was conducted.

Table 1. Summary of Previous Studies

Study	State(s), Number of Observations	School Year	Method Used to Equate Ownership Costs (Contractor/In-house)	Functional Form	Explanatory Variables	Magnitude of Cost Differences
Alspaugh (1996)	Missouri (n = 533[1])	1990-91	None[2]	Linear	Sq. miles in district; Avg. number of pupils daily transported (ADT); Sq. mi./ADT*; Number of attendance centers (schools); Contractor dummy (1= contractor)*; Number of routes; ADT/number of routes*; Average route length (mi.)*; Linear miles/ADT*; Multiple runs dummy (1=multiple runs); Kindergarten routes dummy (1=midday routes)	Costs 9.9% - 10.4% lower when pupil transportation services provided in-house.
Bails (1979)	South Dakota, New Mexico, Minnesota, Oregon, Missouri, Kansas (n = 437[3])	1976-77	None[2]	Linear	Per pupil assessed valuation of taxable property*; Pupils/sq. mi.*; Percentage of population that is urban; Percentage of population that is nonwhite; Avg. salary of government employees in county; Intergovernmental transfers of revenue (state aid)*; Number of school districts in county	Costs lower when services provided by a contractor, but no estimate provided of the magnitude.
Harding (1990)	Indiana (n = 363[4])	1979-80	*Bus:* Amortized cost of buses using straight-line depreciation *Bus maintenance facility:* None[2]	Cox-Box trans-for-mation	Cost/student/mile; Total cost; Total number of trips made by buses in district/day*; Annual inches precipitation in county; Annual payroll in district; Per capita income in county; Percentage of population that is nonwhite; Sq. mi. in county; Avg. earnings of full-time teachers in district; Avg. earnings of other school employees*; In-house dummy (1=in-house)*	Costs 15% lower when pupil transportation services provided in-house.

Table 1. (continued)

Study	State(s), Number of Observations	School Year	Method Used to Equate Ownership Costs (Contractor/In-house)	Functional Form	Explanatory Variables	Magnitude of Cost Differences
Hutchinson & Pratt (1999)	Tennessee (n = 91[5])	1992-93	*Bus:* Amortized cost of buses using straight-line depreciation *Bus maintenance facility:* None[2]	Translog	Avg. daily attendance*; One-way miles driven*; Driver salary*; No. of Large Buses*; No. of Small Buses*; Population Density; Fuel cost/gallon	The costs would have been lower in 15 of the 19 districts that used contractors if the service had been provided in-house.
McGuire & van Cott (1984)	Indiana (n = 275[4])	1979-80	*Bus:* Bus model, year and capacity data used to estimate opportunity costs; 10% rate of return used to equate public ownership with contractor ownership. *Bus maintenance facility:* None[2]	Analysis of Variance[6]	Avg. cost/trip*; Avg. cost/mile; Avg. cost/student; Avg. cost/student/mile*; Avg. length of trip (mi.)*; Avg. number of students/trip	Costs 12% lower when pupil transportation services provided by a contractor.
Ross (1988)	Indiana (n = 274[4])	1979-80	Used McGuire and Van Cott's (1984) data set[4]—see above.	Log-log	Avg. annual cost/trip (000); Avg. number of miles/trip*; Avg. number of students/trip*; Total miles/day*; Avg. number of trips/bus*; Avg. year of manufacture of bus*; Proportion of total miles serviced in-house	Costs 5% lower when pupil transportation services provided by a contractor.

* Statistically significant at the 0.01 or 0.05 level in at least one of the primary model specifications discussed in the paper.
1 All districts in Missouri, except for 2 that did not provide transportation services and 4 that were under federal desegregation court order.
2 No indication provided that any attempt was made to equate ownership costs.
3 Each observation is a county (rather than a school district).
4 McGuire and van Cott (1984), Ross (1988), and Harding (1990) all used Indiana data for the 1979-80 school year. Harding included all districts in the state. McQuire and van Cott did not use data from a number of districts due to incomplete data. Ross used the McQuire and van Cott data set, but eliminated one additional district because of incomplete data.
5 Data for 91 districts that used contractor to provide pupil transportation services was used to estimate model; Costs were then estimated for 19 districts that provided service in-house (e.g., there were 110 districts in TN).
6 Separate analyses for in-house provision and contractor provision.

affect costs, and consider the impact of school finance reforms that occurred during the 1990s.

2. Methods

A variable cost function was estimated for individual school districts in Minnesota for the 1999-2000 school year. Minnesota was selected for this analysis because separate categorical funding was eliminated for most student transportation categories in 1997 (Minnesota Department of Education 2002). School districts in the state should have an incentive to provide regular transportation services as efficiently as possible since most state aid for pupil transportation is included in the general fund. School districts thus are permitted to make decisions about how to use state aid. That is, money not used for pupil transportation can be used for other expenses such as teacher salaries and textbooks. Private contractors might be expected to provide transportation services at less cost than school districts because competition is assumed to occur when contractors bid on contracts. Minnesota also has diverse geographic settings that range from the Minneapolis-St. Paul metropolitan area to isolated rural localities. Sixty percent of the buses in Minnesota were owned by contractors during the 1999-2000 school year (School Transportation 2002). The methods section contains four parts: (1) Model specifications; (2) Data; (3) Procedures; and (4) Endogeneity considerations.

The model was specified as a variable cost function because funding for pupil transportation operations comes from the general fund, while funds for the purchase of buses are considered a capital expense. According to the specified model, the number of students who needed transportation, as well as how the population was dispersed, impacted the output of pupil transportation services.

Three specifications of the cost function were estimated to analyze which specification best represented the data. The first specification used pooled data across all districts, the second specification included a dummy variable for ruralness, and the third specification estimated separate cost functions for rural and nonrural districts. The variables used to explain cost variations are defined in Table 2.

The cost function for the transportation of pupils in an individual school district using pooled data for all districts in Minnesota (where a represents all districts) was specified as shown in equation (I).

$$\begin{aligned} \ln VCOST_a = {} & ß_{0a} + ß_{1a}{*}\ln PUPIL + ß_{2a}{*}\ln MILES + \\ & ß_{3a}{*}\ln WAGE + ß_{4a}{*}\ln FUEL + ß_{5a}{*}\ln SBUS \\ & + ß_{6a}{*}\ln LBUS + ß_{7a}{*}SPECED + \\ & ß_{8a}{*}INHOUSE + \mu \qquad \text{(I)} \end{aligned}$$

Since the functional form of production functions in the bus industry is not known to be non-homothetic, and complex interactions were not anticipated (DeBorger 1984), the model specified for the empirical analysis had a Cobb-Douglas-type functional form. Strictly defined, a variable cost function with a Cobb-Douglas functional form would just include the price of fuel, the price of labor, and the stock of capital. The model estimated in this study included several additional variables and was designed to analyze how production isoquants shifted when certain policy changes occur, rather than to discover complex underlying interactions between inputs (Berndt 1991).

A school district's transportation costs may be affected by both the number of pupils that the district is required to transport (PUPIL) and the size of the network (e.g., MILES—the number of miles of road in the district). MILES and PUPIL serve as a proxy measure of density. In some model specifications we also used the number of students transported per square mile in the district as an alternate measure of density. The results were very similar and consistent to the results obtained with the models that included MILES; therefore, only the results that included MILES are reported in this paper.

Both school districts and private contractors must compete with other firms for labor and fuel and thus are price takers. Most school districts in Minnesota have a bus fleet comprised of both small buses (e.g., Type A, Type B, and Type III buses) and large buses (e.g., Type C and Type D buses). In this analysis the capital stock was measured using one variable for the number of small buses (SBUS) and a second variable for the number of large buses (LBUS). The composition of the bus fleet is a management decision that might affect the efficiency of pupil transportation operations. The percentage of students who required specialized transportation services as a result of a disability was also included as a variable (SPED). The percentage varied between districts and may have an effect on costs and the manner in which pupil transportation services were provided.

A policy dummy variable (INHOUSE) was included in the model to analyze whether school districts that provided pupil transportation services in-house or private contractors were more efficient. If the district provided all pupil transportation services in-house it was set to 1, otherwise it was set to 0. Since bureaucratic school districts would be expected to

Table 2. Definitions of Variables.

Variable	Definition
VCOST	School district variable costs for student transportation, 1999-2000 school year
PUPIL	Number of pupils transported in district
MILES	Number of miles of roads in district
WAGE	Average hourly wage rate for district bus drivers (including benefits)
FUEL	Average fuel price in district
SBUS	Number of small school buses in district
LBUS	Number of large school buses in district
SPECED	Percentage of students in district who required specialized transportation services due to a disability
INHOUSE	Dummy variable (1 if all regular bus services provided in-house; 0 if some or all buses were contracted)
RURAL	Dummy variable (1 if rural; 0 if not rural)

provide pupil transportation services less efficiently than private contractors, INHOUSE was hypothesized to be positive.

Equation I assumed that pupil transportation was provided in a similar manner regardless of locational setting and that the estimated constant term and the other coefficients in the ß vector were the same for both rural and nonrural districts. As previously discussed, this assumption would not consider unique characteristics and management issues that are intrinsic to different geographic settings. For example, a school district in an urban or suburban area may have to contend with more traffic congestion than a district in a rural locality. In other words, school districts in different geographic settings may face inherently different costs. The model was re-specified to include a dummy variable for the locational setting of the district (where d represented the model specification using a dummy variable) as specified in equation (II).

$$\begin{aligned} \ln VCOST_d = {} & ß_{0d} + ß_{1d}{*}\ln PUPIL + ß_{2d}{*}\ln MILES + \\ & ß_{3d}{*}\ln WAGE + ß_{4d}{*}\ln FUEL + ß_{5d}{*}\ln SBUS \\ & + ß_{6d}{*}\ln LBUS + ß_{7d}{*}SPECED + \\ & ß_{8d}{*}INHOUSE + ß_{9d}{*}RURAL + \\ & ß_{10d}{*}INHOUSE\_RURAL + \mu \qquad \text{(II)} \end{aligned}$$

The dummy variable for location was named RURAL and was set at 1 if a district is located in a rural area and was otherwise set at 0. School districts were considered rural if the district administrative office was located outside a Standard Metropolitan Area; the remaining districts were classified as nonrural. The inclusion of a dummy variable that represents the locational setting of a district may be an appropriate way to shift the intercept for different locational geographic areas. An interaction term was also included in the model to account for a possible relationship between ruralness and manner in which pupil transportation is provided (e.g., INHOUSE_RURAL).

The model specification in Equation II assumed that, except for the constant term, estimated parameters and the error term were the same for all districts. If the estimated coefficients of the ß vector actually differed between rural and nonrural districts, this specification would bias the parameter estimates. Some inputs may be more important in some locational settings than in others; therefore, the model was re-estimated separately for rural and nonrural school districts where:

$$\begin{aligned} \ln VCOST_i = {} & ß_{0i} + ß_{1i}{*}\ln PUPIL + ß_{2i}{*}\ln MILES + \\ & ß_{3i}{*}\ln WAGE + ß_{4i}{*}\ln FUEL + ß_{5i}{*}\ln SBUS + \\ & ß_{6i}{*}\ln LBUS + ß_{7i}{*}SPECED + \\ & ß_{8i}{*}INHOUSE + \mu \qquad \text{(III)} \end{aligned}$$

The model specified by Equation III was run twice, once for rural districts (i = rural) and once for nonrural districts (i = nonrural).

A data set containing detailed financial, geographic, and management information about the pupil transportation operations for each of the 343 school districts in Minnesota that provided pupil transportations services was obtained from the Minnesota Department of Education for the 1999-2000 school year. Much of the data is routinely collected by the State; and, the data set included information for both school districts that provided pupil transportation services in-house and districts that used a private contractor. Additional data about how school districts provided pupil transportation was gathered from a survey of school districts that the Minnesota Department of Education administered in 2001. This one-time survey was conducted because of State legislators' interest in understanding how the previously discussed legislative changes in pupil transportation funding in the mid-1990s had impacted school districts.

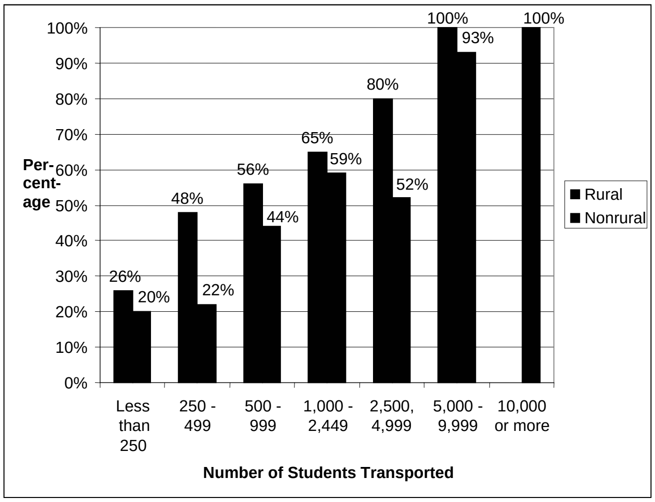

Figure 1. The Percentage of Rural and Nonrural Minnesota School Districts Using Private Contractors to Provide Pupil Transportation Services by District Size , 1999 – 2000.

As indicated in Figure 1, small school districts (which are frequently rural) were much more likely to provide pupil transportation services in-house than larger districts. Twenty-six percent of the rural school districts and 20 percent of the nonrural districts that transported fewer than 250 students used a private contractor to provide transportation services. Most of the largest districts in the state used a contractor to provide some or all pupil transportation services. For example, none of the four rural districts with 5,000 to 9,999 students provided all transportation services in-house and only 7 percent of the nonrural districts in that category provided all transportation services in-house. There were no rural districts in Minnesota that transported more than 10,000 pupils, but all of the nonrural districts in that category used a contractor. The only exception to the trend that a higher proportion of the districts used contractors as the number of students transported increased was for nonrural districts transporting 2,500 to 4,999 students where 52 percent of that group of districts used contractors—which was less than the 59 percent of the nonrural districts transporting 1,000 to 2,499 students that outsourced the service. Means and standard deviations for the variables for all districts are presented in Table 3. Similar information is presented in Table 4 for rural districts and in Table 5 for nonrural districts.

Table 3. All Districts: Mean and Standard Deviations for Variables Included in the Pupil Transportation Cost Function Models, Minnesota, 1999-2000.

	All Districts		**In-house**		**Contractor**	
Variables	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Variable Costs	$753,894	2,003,684	$251,743	281,145	$1,096,0466	2,533,718
Number of Pupils	2,429	5,341	884	1,063	3,481	6,674
Miles of Roads	399	265	374	228	416	287
Hourly Wage Rate [1]	$15.87	2.94	$16.46	3.20	$15.47	2.69
Price per Gallon of Fuel	$1.20	0.11	$1.19	0.15	$1.21	0.14
Number of Small Buses	12	31.01	7	7.78	15	39.36
Number of Large Buses	27	43.01	15	11.53	35	53.50
Percent Special Ed	2.00	2.29	1.33	1.23	2.23	1.63
Number of Observations	*343*		*139*		*204*	

[1]Includes benefits

Table 4. Rural Districts: Mean and Standard Deviations for Variables Included in the Pupil Transportation Cost Function Models, Minnesota, 1999-2000.

	All Rural Districts		In-house		Contractor	
Variables	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Variable Costs	$307,644	323,404	$231,443	206,808	$465,696	452,336
Number of Pupils	1,158	1,271	786	821	1,432	1,440
Miles of Roads	409	243	396	233	412	247
Hourly Wage Rate [1]	$15.88	2.96	$16.31	3.12	$15.54	2.80
Price per Gallon of Fuel	$1.21	0.15	$1.19	0.16	$1.23	0.14
Number of Small Buses	7	6.32	6	7.46	7	20.83
Number of Large Buses	18	13.86	15	10.24	21	14..30
Percent Special Ed	1.55	3.53	1.28	1.23	1.90	0.02
Number of Observations	*249*		*110*		*139*	

[1]Includes benefits

Table 5. Nonrural Districts: Mean and Standard Deviations for Variables Included in the Pupil Transportation Cost Function Models, Minnesota, 1999-2000.

	All Nonrural Districts		In-house		Contractor	
Variables	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Variable Costs	$802,743	961,234	$328,738	464,018	$2,398,554	4,163,640
Number of Pupils	4,866	6,301	1,259	1,662	7,728	10,461
Miles of Roads	374	314	292	189	410	353
Hourly Wage Rate [1]	$15.85	$2.89	$17.03	3.47	$15.33	2.45
Price per Gallon of Fuel	$1.18	0.13	$1.18	0.14	$1.17	0.12
Number of Small Buses	26	56.23	8	8.90	34	66.01
Number of Large Buses	49	74.89	16	1.53	63	85.69
Percent Special Ed	1.69	1.48	1.53	1.21	2.87	1.77
Number of Observations	*94*		*29*		*65*	

[1]Includes benefits

The STATA computer software package was used to estimate the variable cost functions. In preliminary runs, using OLS regression, the Cook-Weisberg test for heteroskedasticity indicated the presence of heteroskedasticity in the models. Classical OLS assumes that the error terms are independently distributed with a mean of zero and a constant variance. Heteroskedasticity is a condition where the residual variance is correlated with one or more of the other variables. Heteroskedasticity often is found in analyses of cross-sectional data where the observations vary substantially in magnitude. Heteroskedasticity does not bias the estimated regression coefficient, but rather affects the variance of the estimated coefficients (Hu 1973). All models in this study were re-estimated using STATA and specifying the *robust* option with the White-corrected standard errors in the presence of heteroskedasticity. The White-corrected estimates are based on the use of a covariance matrix-estimator that correctly estimates the covariances of the coefficients when heteroscedasticity is present. The t-scores reported in this analysis were all White-corrected.

This study makes adjustments for the different methods used to report pupil transportation costs so that accurate efficiency comparisons can be made between districts that provided pupil transportation in-house and districts that used private contractors. In order to arrive at comparable data for this study, the contractor costs were converted to variable costs by estimating and subtracting overhead costs. To estimate the variable costs for districts that used contractors it was necessary to subtract the ownership costs from the reported pupil transportation costs.

Contractors were assumed to consider both operating expenses and overhead costs when they made bids to a school district to provide pupil transportation services. Thus both operating expenses and overhead costs were reflected in the reported expenditures of districts that used a private contractor. The reported expenditures of districts that provided transportation in-house were assumed to reflect only operating expenses. In school districts that provided pupil transportation in-house, district investments in buses and bus maintenance facilities were not annualized and thus the reported expenditures were net of overhead costs. The reported expenditures of districts that used private contractors needed to be adjusted so that they would reflect only the variable costs incurred by the contractors. To net out overhead costs from contractor expenditures, four categories of expenses were subtracted from the reported expenditures for districts that used contractors: (1) the capital service cost of buses owned by contractors; (2) the capital service cost of the contractors' bus maintenance facilities; (3) the insurance costs for the contractors' bus maintenance facilities; and (4) the property taxes for the contractors' bus maintenance facilities.

A capital recovery approach was used to estimate the private contractors' cost of ownership of: (1) school buses; and (2) the bus maintenance facility. The capital service cost (CSC) of the asset is an annuity payment that is required to obtain the services of an asset and considers the time value of money. Assuming that PP represents the purchase price of an asset when it was purchased, SV represents the salvage value when it is sold, r represents the required rate of return on capital, and n represents the number of years that the asset is owned, then:

$$CSC = \frac{(PP - SV)\, r}{1 - (1 + r)^{n}} + SV(r) \qquad \text{(IV)}$$

The CSC calculation of the annuity provided the net present value of the stream of cash flows associated with owning the capital asset on an annual basis. The CSC captured both economic depreciation and the opportunity cost of not having the capital tied up in the asset (AAEA Task Force 1998).

The rate of return used in the cost recovery formula was based upon a weighted average of the rates of return for debt capital and equity capital. The rate of return (r) that was used in this study was 11.3 percent. This rate was selected based upon information gathered from the annual reports of First Group plc (various years), which owns First Student. As indicated in Table 6, for the typical district in the state, 29.5 percent of the total costs were overhead costs (e.g., 24.1 percent for the buses and 5.4 percent for the bus maintenance facility).

Table 6. Average Percentage of Total Costs that are Overhead Costs for Districts that Use a Contractor (Buses and Bus Maintenance Facilities)

	Overhead Costs as a Percentage of Total Costs		
District Type	Buses	Bus Maintenance Facility	Total
All Districts	24.1%	5.4%	29.5%
Rural Districts	23.7%	6.2%	29.9%
Nonrural Districts	25.0%	3.3%	28.3%

The model specifications discussed in this paper assumed that the decisions that school districts make about whether to provide pupil transportation services in-house or outsource are exogenous. However, that assumption may not be realistic and the decision may be correlated with unobserved factors. In other words, does outsourcing impact costs or is the decision to outsource affected by costs?

An instrumental variable approach was used to test for endogeneity. We sought to use a variable that was correlated with outsourcing, but not correlated with the managerial abilities of supervisors. We used the population of the county where the district office was located as an instrumental variable and regressed this variable on the number of pupils transported. We then compared the OLS results with 2-stage regression results using the Hausman test. Specifically, we used Stata's *ivreg* command and then used the *Hausman* command to test whether there were significant differences between the OLS and the 2-stage models. Inferences about the extent to which the decisions that school districts made about the provision of pupil transportation services can then be made by examining the resulting coefficients. A significant coefficient would indicate possible endogeneity. The results indicated that there was a near uniform lack of significance of the coefficients and minimal endogeneity. Although certainly not definitive, we take this as preliminary evidence to suggest that any endogeneity in the manner in which a district provided pupil transportation did not create a significant problem in the interpretation of the results.

It should also be noted that previous studies (see for example, Buse 1992; Nakamura and Nakamura 1998; Park and Davis 2001) have found that IV estimates can be less efficient and introduce bias when cross-sectional data sets are used. Park and Davis concluded that for cross-sectional analyses "a pragmatic way to proceed is to openly acknowledge these theory and data limitations" (p. 849); and, that alternative model results should be reported to provide an indication of how robust the results are.[3]

3. Results

The results of each of the variable cost function estimations using the three model specifications are presented in Table 7.

The variable cost function estimation for the model specification that used the pooled data for all 343 school districts in Minnesota are presented in Table 7 in the column labeled "All Districts". The estimated cost function conforms well to other cost functions for various modes of transportation.

Most of the independent variables were significant and had the expected signs. The number of pupils (PUPIL), the number of miles of road in the district (MILES), the price of fuel (FUEL), and the number of large buses (LBUS) were all positive and statistically significant; while the number of small buses (SBUS) was negative and statistically significant. The dummy variable for the provision of pupil transportation services in-house (INHOUSE) was also negative and statistically significant. Private contractors would be expected to provide pupil transportation less expensively than a bureaucratic school system unless there were market imperfections as discussed above in the section labeled "Market Structure." Thus, the negative sign on INHOUSE suggests that there may be elements of imperfect competition in the pupil transportation industry in Minnesota.

The results for the cost function estimation that included a dummy variable for ruralness (RURAL) are shown in the column of Table 7 labeled "Rural Dummy Variable". The dummy variable that represented ruralness was statistically significant and positive which indicates that there may be some unique characteristics of school districts located in rural settings that shifted the intercept term upward. The interaction term related to method used to provide transportation services and ruralness (e.g., INHOUSE_RURAL) was not found to be statistically significant.

The separate variable cost functions estimated for rural and nonrural school districts are presented in Table 7 in the columns labeled "Rural Districts" and "Nonrural Districts". The results of the cost function estimations have adjusted R^2 values of 0.88 and 0.91 for rural and nonrural school districts, respectively. In rural localities there were not statistically significant differences in costs that occurred as a result of the selection of in-house or contractor provision of pupil transportation services. In nonrural settings, however, costs were significantly lower in school districts that provided all pupil transportation services in-house than in districts that used a contractor.

4. Discussion

Based on the variable cost function estimate that used pooled data for all the districts in the state, the marginal variable cost of transporting an additional pupil was 10 percent less if a district provided all pupil transportation services in-house than if a contractor

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[3] The estimation of a Probit model could also be used to test for endogeneity. The development of such a Probit model, though beyond the scope of this paper, is part of our future research agenda

Table 7. Independent Parameter Estimates and White-adjusted t-scores, Minnesota, 1999-2000.

Dependent Variable: lnVCOST	All Districts		Rural Dummy Variable (All Districts)		Rural Districts		Nonrural Districts	
Parameter	Coefficient	t-Score	Coefficient	t-Score	Coefficient	t-Score	Coefficient	t-Score
Intercept	6.31	17.17**	6.15	16.46**	6.06	14.76**	6.80	8.19**
LnPUPIL	0.69	15.27**	0.72	15.41**	0.75	13.81**	0.64	6.67**
LnMILES	0.10	4.63**	0.09	4.12**	0.06	2.59**	0.19	3.43**
LnWAGE	0.08	0.77	0.07	0.69	0.09	0.79	- 0.02	- 0.10
LnFUEL	0.21	1.74*	0.20	1.60	0.17	1.86*	0.05	0.15
LnSBUS	- 0.06	- 2.13*	- 0.05	- 1.34	- 0.05	- 1.40	- 0.02	- 0.38
LnLBUS	0.23	3.73**	0.22	3.57**	0.24	3.39**	0.12	0.94
LnSPECED	- 0.03	- 1.48	- 0.03	- 1.24	-0.02	- 0.68	-0.05	- 1.00
INHOUSE	- 0.07	- 1.65*	- 0.01	- 0.13	-0.04	- 0.96	-0.18	- 1.76*
RURAL			0.12	2.08*				
INHOUSE_RURAL			- 0.07	- 0.74				
Number of observations	343		343		249		94	
Adjusted R^2	0.90		0.90		0.88		0.91	

Note: T-scores are White-adjusted.

was used at the mean district size. When the marginal costs were estimated separately for rural and nonrural districts (e.g., the models specified by Equation III), the marginal cost of transporting an additional pupil in a rural district did not differ significantly between districts that used contractors and districts that provided the service in-house. Marginal costs in an average-sized nonrural district (e.g., 4,866 pupils) were estimated to be 12 percent lower if the service was provided in-house than if a contractor was used.

The results indicate across multiple model specifications that contracting was not necessarily more efficient than providing pupil transportation services in-house. The first regression, which included data for all districts, showed that in-house provision was more efficient. When separate regressions were run for rural and nonrural districts, the results indicated that in-house provision was more efficient only for nonrural districts. Since private contractors might be expected to provide pupil transportation services more efficiently than districts that provide the service in-house, market imperfections may exist in the pupil transportation industry—particularly in nonrural settings (e.g., urban and suburban locations). Possible imperfections might limit pricing and service competition between contractors when a district uses a contractor to provide all services.

This study provides preliminary indications that, under current structural arrangements in Minnesota during the 1999-2000 school year, it was not more efficient to outsource pupil transportation; but, since pupil transportation operates within a political environment and the industry does not operate under a scenario of pure competition, no obvious definitive conclusions can be drawn. A limitation of this analysis is the use of cross-sectional data. The data provides a snapshot of the pupil transportation industry in Minnesota at a point in time, but does not address how the industry has changed over time.

The results of this study support the conclusions of Harding (1990) and Alspaugh (1996) that in-house provision was most efficient; however, they contradict the findings of Bails (1979), McGuire and van Cott (1984), Ross (1988), and Hutchinson and Pratt (1999). These results therefore further complicate the literature and strongly indicate the need for additional research using data from other states and years to gather additional evidence about whether or not pupil transportation services are provided more cost effectively in-house.

It also should be noted that school districts may sometimes use non-monetary rationales to make decisions about how to provide pupil transportation services; and that the use of non-monetary rationales may make interpretation of the results more difficult. For example, some districts may choose to outsource pupil transportation, even if it costs more than providing it in-house, because of reduced administrative opportunity costs, reduced managerial hassles, and the desire to enable school administrators to focus their attention on core instructional functions. Other districts may choose to maintain pupil services in-house because of the perception—though there is little empirical evidence—that in-house provision may provide safer and higher-quality services (Lazarus 2004).

5. Conclusions and Policy Implications

Outsourcing of pupil transportation (and other services) needs to be judiciously undertaken and monitored. Although the literature suggests that outsourcing theoretically has many benefits, the literature also has a number of caveats concerning the need for a competitive bidding process. One of the strongest appeals of outsourcing is the desire to use competition to control costs; however, complete dependence on a single supplier may not decrease costs. Morgan (1992) concluded that "private managers in a sheltered environment may act much like their bureaucratic counterparts" (p. 257).

This analysis indicates that small (typically rural) school districts were much more likely to provide pupil transportation services in-house than nonrural districts. This suggests that major contractors may be showing little interest in pursuing contracts with rural school districts while focusing their efforts on larger school districts. With several national and international corporations active in the Minnesota pupil transportation market, there may be a need for the development of contract provisions and bidding processes that better protect the public interest in all geographic settings in the state.

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