

# Small Transit Insurance Programs: Current Status and the Group Purchase Alternative

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## ABSTRACT

The recent development of a competitive market for transit insurance provides an opportunity for small transit systems to achieve large savings in their insurance costs with a relatively small investment of time and resources to improve their insurance awareness and to develop an effective marketing strategy. Operating profiles, insurance expenditures, and accident rate information for 115 small transit systems are presented in order to provide a framework for a more detailed discussion of their insurance procurement procedures and overall risk management programs. Specific recommendations are developed on the basis of an analysis of insurance procurement procedures of the small systems and the carrier and agent service provided to them as well as a risk profile evaluation for them. The alternative of group purchase, including an effective implementation scheme, is also discussed. The results demonstrate that one group of six small transit systems in Maryland could have decreased their 1982 premiums for primary and excess liability coverage by \$94,744--a decrease of 55 percent--if they had entered into a joint purchase program. A premium allocation scheme is presented, which meets fairness tests and assures all members that every member will attempt to maintain excellent safety and loss control programs.

In view of the continuing pressures to limit government spending at all levels, there is a definite need for small transit systems to investigate a variety of ways to decrease their operating costs. The recent development of a competitive market for transit insurance provides an opportunity for small systems to explore insurance costs as an area for reducing their overall costs, because these costs typically represent an important component of the total. The investigation of the insurance programs of small transit systems, including the possibilities of group purchase plans, is thus a timely endeavor.

Historically, there has been little effective competition among suppliers in the transit insurance market. Transit managers considered themselves fortunate if they were able to find any insurance carrier interested in handling their business. Transit managers, indeed, have asserted that the only insurance carriers seeking their business were those who believed that writing the transit business was a prerequisite for obtaining other city or county insurance business.

In the past several years, however, there has been a significant increase in competition for the transit insurance business among insurance suppliers. The majority of transit operators, especially of small systems, has not been aware of this increased competition for transit insurance business. As results reported in this paper indicate, transit operators have an opportunity to achieve large savings in their insurance costs with a relatively small investment of time and resources to improve their insurance awareness and to develop an effective marketing strategy. The major objective of this paper is to discuss the existing insurance programs of small transit systems nationwide and to make specific suggestions for their improvement.

## DATA BASE

During the summer and fall of 1983 the College of Business and Management of the University of Maryland at the request of the state of Maryland's Mass Transit Administration investigated and evaluated the insurance purchasing programs of seven small urban and rural transit systems in the state.

As part of this investigation, operating profile, insurance expenditure, and accident rate data were collected for 115 small transit systems with up to 40 buses in their vehicle fleets. These systems were included in UMTA's National Urban Mass Transportation Statistics, Second Annual Report (1). The 115 firms in the data base were sent questionnaires requesting information on insurance procurement, carrier and agent services, insurance premiums, and losses from a recent year. Forty-eight (approximately 42 percent) answered the questions about insurance procurement and carrier and agent services. However, only 16 provided the data on insurance premiums and losses needed to perform a risk evaluation.

Throughout the paper, the primary focus will be on the 115 small urban and rural transit systems as well as on those who responded to the questionnaire seeking more detailed insurance information. The results of the specific investigation of the Maryland small transit systems, detailed in a separate report (2), will be referred to only for illustrative or comparative purposes.

## OPERATING PROFILES: INSURANCE EXPENDITURES, AND ACCIDENT RATES

A statistical analysis of the 115 small transit operations was performed to produce a profile of relevant aspects of their operations in order to es-

establish a context for a detailed discussion of insurance programs. The relevant variables available in the UMTA statistical report cited earlier are operating expenditures and number of buses as size indicators, average age of the bus fleet, total casualty and liability expenditures as a percentage of total operating costs, and total accidents per million vehicle-miles. The relationships involved are given in Table 1.

As the data in Table 1 indicate, the 115 small transit firms have an average annual operating expense of \$880,310 and a median expense of \$741,500, with values ranging from a low of \$17,850 to a high of about \$4.2 million. About 20 percent of the small transit systems have 10 or fewer buses, and another 20 percent have between 29 and 40 buses. The mean number of buses among the firms is 19.4. The average fleet age for the small transit firms is 8.8 years. Approximately 20 percent of the systems, however, have fleets with an average age of 5 years or less. At the other extreme, approximately 20 percent have fleets with an average age of 12 years or more, with a maximum fleet age of 27.7 years.

TABLE 1 Selected Operating and Financial Data: Small Transit Firms

Variable	Mean	Median	Maximum
Operating expenses (\$)	880,310	740,500	4,199,370
No. of buses	19.4	18.6	40
Fleet age (years)	8.8	8.1	27.7
Casualty and liability expenses (\$)	48,432	40,075	229,043
Casualty and liability expenses as percentage of operating expenses	6.0	5.5	14.6
Accidents per million vehicle-miles	48.3	41.6	206.8

Note: Number of transit firms = 115.

System outlays for casualty and liability expenses range from a low of \$13,680 to a high of \$229,043, with a mean expense of \$48,432. Translating the absolute casualty and liability expenses into a percentage of total operating expenses provides an indication of the importance of this cost category. The 115 firms average 6.0 percent of their operating expenses devoted to casualty and liability expenses. However, about 10 percent of the firms devote at least 10 percent of their operating expenses to this category, with one firm spending 14.6 percent in this category.

Small transit firms have an average of 48.3 accidents per million vehicle-miles, ranging from a low of no accidents (11 percent of the firms) to a high of 207 accidents per million vehicle-miles. Eight percent of the firms had 100 or more accidents per million vehicle-miles.

The relationships among these variables are of interest, particularly the influence of various factors on casualty and liability outlays. A reasonable hypothesis or expectation is that casualty and liability expenditures in both absolute terms and relative to total operating expenses are influenced by system size, fleet age, and accident rate. According to the statistical analysis, however, only size shows a consistent relationship.

There is a strong positive relationship (with high correlation coefficients and statistical significance) between casualty and liability expenditures and (a) total operating expenses ( $R = .67$ ), and (b) number of buses ( $R = .58$ ). This simply confirms the expectation that the bigger the system in terms of operating expenses and number of buses operated, the greater the casualty and liability outlays. However, there is a significant relation-

ship between the percentage these outlays are of total operating expenses and (a) operating expenses ( $R = -.31$ ), and (b) the number of buses operated ( $R = -.35$ ). As shown these coefficients are negative, indicating that smaller firms (as measured by these indicators) are generally required to devote a larger proportion of their resources to this function than are larger firms. This suggests either a threshold effect, which requires a minimum amount of expenditures for this purpose regardless of the smallness of the operation, or economies of scale, which stipulate that these expenditures do not increase proportionately with size, or both.

The extremely low and statistically nonsignificant correlation coefficients confirm the random relationship between casualty and liability expenditures (in terms of operating expenses) and fleet age ( $R = -.01$ ) and accident rates ( $R = -.16$ ).

The presentation of operating profile, insurance expenditure, and accident data from the small transit firms provides a framework for the more detailed discussion of the insurance programs of the small systems. The data confirm that insurance expenditures are an important identifiable component of total operating costs and therefore are a target for cost reduction. An analysis of the relationship among the variables does not confirm any expectations of a linkage between accident rates or fleet age and insurance expenditures. Thus, accident rates and fleet age are not good predictors of the share of a firm's operating expenses devoted to insurance premiums. The statistical analysis only confirmed a relationship between firm size and insurance burden, with smaller firms carrying a significantly greater insurance burden than do large firms.

#### INSURANCE PROCUREMENT AND CARRIER AND AGENT SERVICES

In this section are documented, for the small transit firms, (a) insurance procurement procedures and (b) carrier and agent services provided.

##### Insurance Procurement Procedures

A major issue concerning the insurance procurement procedures of small transit systems is the amount of attention that the issue receives at the firm level as indicated by the person who has the authority to purchase the insurance. There is no question that the transit managers, perhaps with the assistance of or input from insurance specialists, should have the primary knowledge of and ultimate responsibility for procurement of the system's insurance. Without such knowledge and responsibility, the manager is not in a position to develop the kinds of programs and policies that could make insurance procurement more cost-effective.

Although slightly more than half (51 percent) of the small transit systems reported in response to the questionnaire that the manager or director of the system has the insurance procurement authority, a sizable share of the transit managers do not have this authority. Table 2 gives the distribution of firms on the basis of who has the authority to purchase the system's insurance.

For most of the transit systems the managers of which lack the authority to purchase insurance, this authority rests with various departments or legislative bodies of the city or county in which the system is located. The city or county departments or bodies with the authority include the insurance department, the finance and purchase office, the government's purchasing agent, the city or county

**TABLE 2 Individual with Authority to Purchase Transit Vehicle Insurance<sup>a</sup>**

Title	Percentage of Firms
Manager, director of system	51.1
Insurance manager, city or county	17.8
City finance and purchase office	8.9
Board of directors	8.9
City council	4.5
General management company	2.2
Board of public works	2.2
State insurance purchasing board	2.2
Purchasing agent for city	2.2
Total	100.0

<sup>a</sup>Based on responses of 45 firms, 3 nonresponses.

council, the board of public works, and so forth. However, the authority for insurance procurement is too central to the task of transit management and too intertwined with other system policies to remove it from the transit manager's overall job responsibilities.

A strong indication of the potential for acquiring cost-effective transit insurance is given by whether the transit insurance is purchased on its own or in combination with insurance covering the vehicles of other government entities. Grouping transit vehicles with those of other government agencies prohibits the assessment of the cost of providing insurance to the transit vehicles by themselves and reflects the belief that insurance carriers will write policies for transit insurance only if it is combined with other business. Insurance companies with a major interest in transit insurance, however, are not interested in writing policies covering vehicles of nontransit government entities and will not bid on such combined business. Officials of three out of four small transit systems said in response to the questionnaire that they purchase their transit vehicular insurance as a separate policy instead of grouping it with other business.

Certainly, competitive bids are a prerequisite to obtaining cost-effective transit insurance. It is hoped that a competitive situation will provide the system with a choice of policies that fill its insurance needs. Officials of more than eight out of ten firms said that their insurance policies are subjected to a competitive bid process. No attempt was made to determine whether the companies have experienced a wider choice of policies with the competitive bidding process than they did before its adoption. Among the firms with competitive bidding, 58 percent have a 1-year bid frequency, 2.5 percent have a 2-year frequency, 37 percent have a 3-year frequency, and 2.5 percent have a 5-year frequency.

The questionnaire included an item asking the transit firms to identify the factors that the insurance carriers used as a basis for determining their transit vehicle insurance premiums. Table 3 is a checklist of possible influencing factors; it gives the percentage of the firms that checked each of the items listed on the questionnaire. More than half of the firms selected passenger- and vehicle-miles as the basis for premium determination and about 42 percent also specified loss rate. Other important factors mentioned by at least 30 percent of the firms are vehicle age and condition and number of claims.

#### Carrier and Agent Services

Any evaluation of an insurance program should include information on the type and level of services

**TABLE 3 Basis for Premium: Small Transit Systems<sup>a</sup>**

Rating Factors	Percentage of Firms Mentioning Factor
Revenue	14.6
Passenger- or vehicle-miles	50.0
Vehicle age and condition	33.3
Risk management program	12.5
Size of buses	25.0
No. of claims	33.3
Radius of operations	14.6
Loss ratio	41.7
Other (group purchase plan, composite rating)	18.8

<sup>a</sup>Data from the 48 transit firms who answered questionnaire.

provided to the systems by the carriers and agents who handle the business. There are wide differences in the types of services provided. Those transit systems with significantly fewer services from their respective carrier or agent are at a distinct disadvantage in developing a cost-effective insurance program.

A critical component of an overall program to reduce insurance risk is effective safety and loss control inspections. Experienced insurance agents can provide transit systems with a great service by conducting safety and loss control inspections and making suggestions about actions that transit managers can take to reduce those losses. Only 4 percent of the transit systems reported that their insurance carriers or agents have no safety inspections during the course of a year (Table 3). About 61 percent have one or two inspections, an additional 7 percent have three, and 28 percent have four or more.

Another important aspect of loss control and prevention is an accurate picture of past losses so that problem areas can be identified. Approximately three out of four of the small transit systems reported that their carrier or agent provides them with regular loss experience reports. Certainly, every transit manager needs to be aware of the sources of insurance losses in order to prevent their recurrence.

If insurance carriers and agents do nothing more for the transit system, they should at least provide efficient handling of the system's complaints. More than nine out of ten of the transit systems responding to the questionnaire reported that their carriers or agents provide them with efficient claims handling.

Finally, there are specific activities that have been identified as components of an overall program to obtain cost-effective transit insurance through risk reduction. These include the establishment of driver award programs and detailed driver record checks as well as overall upgrading of system safety programs. Carriers and agents can provide significant assistance in these areas. Unfortunately, only 23 percent of the transit systems reported that their carriers or agents assist in driver award programs, 40 percent said that they provide driver record checks, and 50 percent mentioned that they help upgrade system safety programs.

#### **RISK PROFILE EVALUATION**

Adequate risk management programs, involving (a) risk identification, (b) risk control or elimination, (c) risk profile, and (d) the risk assumption decision, are important for the transit system manager. Although it is true that all transit managers

have at least informal risk management procedures, a formal process will aid in clarifying the risk management process. Although some specific components of risk control or elimination (e.g., safety inspections, good driver awards, loss reports) have been addressed, a risk profile for small transit systems is provided in this section. The risk profile is a central tool to use in determining a firm's risk assumption capabilities as well as its insurance coverage requirements.

A risk profile is based on the detailed insurance premium and loss history information provided by personnel at 16 of the 48 small transit systems who responded to the questionnaire. Where appropriate, reference is made to the insurance premium and loss history information provided by the Maryland firms.

A risk profile focuses on six key measurements that are presented in the following paragraphs.

#### Cost-of-Risk Ratio

The cost of risk for a transit system, in general, is a measure that should be comprised of the following four components: (a) insurance premiums, (b) costs of safety and loss control programs, (c) costs of insurance administration, and (d) costs of uninsured losses for the year. The most important cost-of-risk ratio is the total cost of risk divided by the transit system's operating expenses.

Although total cost of risk includes all of the four components, this analysis focuses only on the cost of premiums. Data collection constraints prevented the use of the other components. This omission is not a serious problem because premiums usually comprise the largest proportion of these costs and are always the component of greatest interest.

Analysis of the 16 small transit systems indicates that their average cost-of-risk percentage is 3.33 with a standard deviation of 1.83. Thus, approximately 70 percent of the small transit systems should have a cost-of-risk ratio (based on premiums only) somewhere between 2.0 and 5.2 percent. The average cost-of-risk percentage for the Maryland firms is 9.1--high relative to the 16 sample firms.

#### Liability Premiums as a Percentage of Operating Expenses

Another measure of premium levels is liability premiums as a percentage of operating expenses. The 16 small transit systems have an average of 2.62 for this ratio, whereas the average for the Maryland transit systems is 7.62 percent.

#### Collision and Comprehensive Premiums

Not unlike the ratio of liability premiums to operating expenses, the ratio of collision and comprehensive premiums to operating expenses is lower for the 16 small transit firms than for the Maryland transit systems. The average ratio for the Maryland systems is 1.76 compared to the average ratio of 0.68 for the 16 small transit systems.

#### Casualty and Liability Losses

One measure of a firm's ability to withstand losses is the ratio of total losses to the firm's operating expenses. One recent study on transit insurance reports: "One guideline is that fluctuations of 1% to 5% of the annual budget will not be considered

materially or financially dislocating. . . . The casualty and liability cost category of the transit budget is the relevant item for a transit system" (3,p.27). The study recommends that transit systems adopt 1 percent of operating expenses as their risk retention guideline. For the 16 small transit systems casualty and liability losses represent 0.7 percent of total operating expenses. For the Maryland firms this figure increases to 1.1 percent.

#### Collision Deductibles as a Percentage of Operating Expense

Deductible levels are among the most difficult aspects of transit insurance to analyze, yet deductibles represent the most facile form of insurance retention. The previous subsection provided some general guidelines for deductibles.

The average collision deductible for the small transit systems is \$983. (However, one of the 16 small transit systems has a collision deductible of \$10,000. If this is included, the average collision deductible for the small systems is \$1,676.) The Maryland firms have an average deductible of \$650.

For the small firms, deductibles as a percentage of operating expenses average 0.09 (or 0.13 with the firm with a \$10,000 deductible included), whereas the average for the Maryland firms is 0.16. It is clear that the 16 small transit systems as well as the Maryland systems have an opportunity to increase their collision deductibles considerably without violating the risk self-retention guidelines mentioned in the previous subsection.

#### Loss Ratios

Loss ratios, central to an insurance analysis, compare the amount of loss paid out in claims for 1 year with the premiums paid for a particular layer of insurance. They can be expressed as loss dollars divided by premium dollars times 100.

Tracking loss ratios can be helpful to a transit system in several ways. First, they can aid in determining whether the system is in good position for greater risk assumption. Second, loss ratios can be used as a simple measure of the effectiveness of a system's loss control program when properly tracked over time. Third, loss ratios may aid the transit manager in choosing alternative coverage levels.

The 16 small transit firms have an average primary liability loss ratio of 22.4 percent (excluding one firm with a 775.0 percent ratio), whereas the average for the Maryland firms is only 9.5 percent. The loss ratio represents data for only 1 year. Although it is more important to observe time trends and variability in loss ratios than to simply look at performance during 1 year, small transit managers have difficulty enough producing data for 1 year. It is hoped that greater recognition of the importance of loss rate information will lead to more comprehensive data collection.

#### SUMMARY AND CONCLUSIONS

A set of general principles regarding the risk management process as well as their application to the small transit system are presented. The general principles are based on previous reviews of transit insurance as well as knowledge gained from this study of the small transit systems nationwide as well as the Maryland systems. The final principle presented deals with the advantages of a joint purchase alternative and a specific course of action for its implementation.

### Purchase of Insurance

Transit managers should have direct responsibility for the purchase of their vehicle insurance and maintain required supporting records of coverage levels, premiums, deductibles, loss histories, and methods of premium determination.

Nearly half of the small transit systems who responded to our questionnaire indicated that no individual in the transit system has responsibility for the purchase of transit vehicle insurance. Many small systems give this responsibility to city or county insurance directors who have responsibility for the purchase of all county insurance. Transit vehicle insurance is only a small part of their total work effort.

Many small transit systems rely on insurance agents to keep all their insurance records. Transit systems, however, should not depend on agents but should maintain their own insurance records including specifically premiums, coverage levels, and loss histories so they can calculate the straightforward ratios previously described. The agent should provide the system with documentation about these matters in a form that permits their ready use in a risk management program.

### Specifications

Transit managers should be actively involved in the preparation of insurance specifications as part of the bidding process.

Many small transit systems rely heavily on their agents to determine their coverage levels, deductibles, and other insurance matters. It is not uncommon for the agent who currently has the transit company's vehicle insurance policy to review or even collaborate in the writing of specifications for the subsequent year's policy even though the agent will be bidding for that business. The self-interest of an agent who works on a commission basis may not coincide with the best interests of the transit system. On the basis of the analysis of the Maryland systems, the agents do not advise the systems about alternative levels of coverage and deductibles. There is no evidence that the agents calculate for the systems the type of ratios presented in the last section for consideration in determining coverage levels and deductibles.

### Services

Carrier and agent services provided to transit systems should include all of the following: safety inspections, loss reports, efficient claims handling, assistance with driver awards, checking of driver records, and assistance with a safety upgrade program.

The survey of small transit systems revealed that only 23 percent receive assistance with driver awards from their agents, only 40 percent have agents who check driver records, and only 50 percent have agents who assist with safety upgrade programs. It is recommended that all transit systems become aware of these services and include their agent's willingness to provide them in an overall evaluation of the agent.

### Excess Liability

Small transit systems should obtain excess liability coverage so that their total coverage ranges between \$2.5 million (minimum) and \$5 million.

The level of excess liability that should be held by a transportation system is an extremely judgmental matter. Many experts indicate that there has been an upward drift in types of risk in which a loss could bankrupt a system. They encourage transit systems to obtain a minimum of \$5 million in total liability coverage; this is probably too conservative for many small transit systems. The detailed analysis of the Maryland systems indicated that excess liability should range between \$2.5 million and \$5.0 million.

### Self-Retention of Risks

Small transit systems should pursue the option of self-retention of liability risks.

Assuming that there are no legal obstacles to a self-retention risk program, the only apparent problem is budgetary. Transit managers avoid self-retention programs because of concern that amounts budgeted and not used for paying claims will be eliminated from the following year's budget.

If this obstacle can be overcome, transit managers should give serious consideration to the adoption of the 1 percent guideline for risk retention. Previous studies indicate substantial premium savings available from modest increases in deductible levels (3,p.8).

### Lower Cost Insurance

Small transit systems should be able to use their favorable loss ratios as a bargaining chip in their effort to obtain lower cost insurance.

Insurers, in general, attempt to achieve a loss ratio of 60 percent and use the other 40 percent of the premium dollar for expenses and profit. As detailed earlier, the loss experience of the small transit systems is generally favorable. The 16 small transit systems reporting detailed information had an average loss ratio of 22.4 percent (excluding one outlier firm).

Although data from the 16 firms covered only 1 year, the small transit systems have achieved remarkably low loss ratios. The detailed analysis of loss ratios for the Maryland systems, covering multiple years, confirmed an overall low loss ratio for the small transit systems. It can be concluded that providing transit insurance to the small transit systems has been a highly profitable endeavor. The implication is that favorable loss ratios should enable small transit systems to individually obtain lower cost insurance.

### Joint Purchase Program

A joint purchase program to tap the competitive market for transit insurance should be investigated.

The recent large increases in insurance premiums have stimulated interest in joint purchase programs in order to pool risks and to offset otherwise high premiums. This interest has encouraged a number of insurance carriers, in cooperation with transit associations, to offer a variety of such insurance packages that have numerous advantages in terms of cost savings and improved services.

One such association, the United Bus Owners Association (UBOA), provided premium quotations for a joint program covering six small Maryland transit systems. Under the UBOA program, some Maryland transit systems could increase their liability protection and all could decrease their premiums as a

group by a total of \$94,744--a decrease of 55 percent compared to 1982 premiums.

Given the significant cost advantages associated with a group purchase plan as demonstrated in the example of the Maryland systems, it is important to understand why small transit systems have been slow to respond to the opportunity for substantial savings. In addition to the problem of a lack of awareness of insurance matters in general as well as of the specifics of group purchase on the part of small transit operators, there are three explanations for the lack of response to the group purchase alternative on the part of the small transit systems. First, legal and institutional barriers may prohibit a group purchase program. Second, there are problems concerning allocation of the joint premium among the individual systems. Third, there is the problem of moral hazard.

Legal and institutional barriers could be of several different types. Some states have statutes that simply prohibit government agencies from entering into joint ventures for insurance procurement purposes. In addition, provincialism or regional pride, which would simply prevent such agreements, might exist. For example, a small system's good relationship with a local broker would be threatened in a group purchase scheme. More important, buyer ignorance, as this study has shown, is widespread throughout small transit systems. Most transit systems simply have not realized that substantial savings could be achieved in insurance procurement through a joint purchase program.

Although the legal barrier could be overcome by action of the state legislature, provincialism is a more difficult obstacle to resolve. However, in the future, as the potential savings increase, this barrier might also be overcome. Widespread diffusion of information about the insurance options that are available has begun to raise the level of awareness of potential buyers. As this information continues to spread, buyer ignorance will tend to disappear.

The problem of fair allocation of the joint premium among the systems and moral hazard at first seem inexorable ones. Unless each individual transit system in the joint agreement receives some savings from the economies of scale, which it considers fair, it will leave the group program. Moreover, there has to be some mechanism that assures all members that every member will attempt to maintain excellent safety and loss control programs. That is, the moral hazard problem must be eliminated. The joint purchase program presented hereafter addresses the problems of fair allocation and moral hazard.

Initially, the joint premium should be allocated on the basis of premiums paid by each system before entering the joint agreement. (The exact allocation formula to be used will be discussed later.) Subsequently, every 3 years (or any other time period agreed on), each system would be required to seek bids for insuring that system alone. The lowest bid that each system received would serve as a basis for computing the portion of the joint premium each system must pay. As will be shown, this method not only provides for fairness in allocation of the joint premium but, more important, rewards those systems that improve or maintain safety and loss control.

To demonstrate the workings of this system, assume that there are three small transit systems--A, B, and C. Further, assume that the individual bids they received for insurance are as given in Table 4 and that the premium for entering various joint purchase agreements are as given in Table 5. Thus, if all three transit systems purchased insurance jointly, their premium would be \$60,000 and substantial savings would be achieved. One simple method that might be used to allocate the \$60,000

TABLE 4 Hypothetical Insurance Premiums: Lowest Bid

System	Lowest Bid Premium (\$)
A	50,000
B	25,000
C	35,000
Total	110,000

TABLE 5 Hypothetical Insurance Premiums for Joint Agreements

System Combination	Premiums for Joint Agreements (\$)
A + B	45,000
A + C	45,000
B + C	50,000
A + B + C	60,000

would be to compute allocation factors based on the premiums paid assuming no subcoalitions such as A + B, B + C, C + A could be formed. Under this method, the allocation factors, using only data in Table 4, would be computed as follows:

$$F(A) = 50,000/110,000 = 0.45$$

$$F(B) = 25,000/110,000 = 0.23$$

$$F(C) = 35,000/110,000 = 0.32$$

$$\text{Total} \quad \quad \quad 1.00$$

where  $F(i)$  is the allocation factor for the  $i$ th transit system. Under this scheme, transit systems A, B, and C would pay 45, 23, and 32 percent, respectively, of the \$60,000 joint premium. That is, the premiums paid by A, B, and C under the joint agreement would be \$27,000, \$13,800, and \$19,200, respectively.

This simple allocation rule satisfies the following axioms of fairness:

1. No transit system pays more than the lowest bid individual premium that it could achieve by itself.
2. Every transit system shares in the savings due to the joint purchase agreement.
3. The sum of the individual allocations is equal to the joint purchase agreement premium.
4. The allocation is homogeneous of degree one in premiums. That is, a 10 percent increase in the lowest individual premium for all transit systems results in a 10 percent increase in the final allocation to each transit system.

Although this allocation rule satisfies some important fairness criteria, if the assumption of no subcoalition formation is relaxed, the rule might have a possible shortcoming. The first column in Table 6 gives the premiums that would be paid by both individuals and subcoalitions if this simple rule were used (note that the subcoalition numbers such as A + B are simply the sum of the premiums allocated to A and B (i.e., for A + B, \$27,000 + \$13,800 = \$40,800). Column 2 gives the lowest bid premiums that individual operators and subcoalitions could achieve.

From the data in Table 6 it is clear that all subcoalitions except A + C would be better off by entering the joint purchase agreement (i.e., A + C, by forming a subcoalition by themselves and not joining the coalition A + B + C, would pay only \$45,000 in premiums. Under the allocation rule, A + C by joining with C must pay \$46,200).

**TABLE 6 Comparison of Premiums Under Allocation Rule to Lowest Possible Premiums**

System or Combination	Premiums Under the Allocation Rule (\$)	Lowest Possible Premium (\$)
A	27,000	50,000
B	13,800	25,000
C	19,200	35,000
A + B	40,800	45,000
A + C	46,200	45,000
B + C	43,000	50,000
A + B + C	60,000	60,000

Thus, although this simple rule works well where no subcoalitions such as A + C can be formed, the rule occasionally fails when the complexities of subcoalitions are added. When the simple rule fails, slightly more complex rules can be used such as the Shapely Value and the Generalized Shapely Value. The formula for premiums under the Shapely Value is

$$P_i = \sum [(s - 1)! (m - s)! / m!] [v(s) - v(s - i)]$$

where

- $P_i$  = premium for individual transit system  $i$ ;
- $s$  = number of members of subcoalitions (in this case,  $s$  can equal 1, 2, or 3);
- $m$  = total number of possible transit systems in the joint purchase agreement (in this example,  $m = 3$ );
- $v(s)$  = insurance premium for subcoalition  $s$  (e.g., for A + B in this example,  $v(A + B) = \$45,000$ ); and
- $v(s - i)$  = premium that coalition  $s$  would have to pay if individual member  $i$  dropped out (e.g.,  $v(A + B + C - A) = \$50,000$ ).

The premiums for members of the joint purchase agreement as computed by the Shapely Formula would be \$25,000, \$14,991.17, and \$19,999.83, for A, B, and C, respectively. Although just barely satisfying subcoalition A + C, the Shapely Value allocations do satisfy all subcoalitions. The allocations also satisfy the first three axioms of fairness. In addition, axiom 4 would be altered to read: The allocation is homogeneous of degree one in incremental changes in premiums.

Table 7 gives the actual liability premiums paid by six small urban and rural transit systems in

**TABLE 7 Illustrative Example of Savings Potential Associated with Joint Purchase Agreement**

System	1982 Premium (\$)	F(i)	Allocation Under Joint Purchase (\$)	Potential Savings (\$)
1	24,316	.14	11,008.22	13,307.78
2	16,536	.10	7,443.25	9,092.75
3	9,984	.06	4,493.83	5,490.17
4	26,624	.15	11,983.54	14,640.46
5	14,600	.08	6,571.50	8,028.50
6	80,324	.47	<u>36,154.05</u>	<u>44,169.95</u>
Total	172,294		77,550.00	94,744.00

Maryland in 1982 (Column 2). Column 3 provides the allocation factors based on a joint purchase plan that had a premium (for both primary and excess liability) of \$77,550. Column 4 contains the premiums that would be paid under the joint agreement, and Column 5 gives the savings for each system. This simple example illustrates that each system had the potential to cut its insurance premium by anywhere from 45 to 57 percent with the group purchase alternative.

The illustrative example demonstrates that potential problems associated with a group purchase plan can be resolved. The rewards for the resolution of the problems are substantial. It is believed that small transit systems across the country could successfully implement a group purchase program if they invested some additional time and effort in studying their insurance policies and their overall risk management program.

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