COST CHARACTERISTICS OF BUS AND JEEPNEY TRANSPORT SYSTEMS IN METRO MANILA

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abstract: This paper focuses on the cost structures of bus and jeepney transport systems in Metro Manila. Cost functions for this modes were developed in order to identify policy recommendations related to the cost aspect of public transport regulation and management. The main findings were that economies of scale exists in bus operations but there was no conclusive result on economies of scale for jeepneys. Another was that bus-kilometer and average speed significantly affects operations. The significance of fuel consumption to these particular systems was also proven. Based on these findings, this paper recommends the encouragement of the growth of large companies and the improvement of the turn around time.

1. INTRODUCTION

In Metro Manila, buses and jeepneys are the predominant modes of public transportation. But then, though they largely cater to the transport needs of the metropolitan area and its environs, operators are always claiming that the business is unprofitable and that they are incurring huge losses. Along with this, the bus and jeepney fare rates regulated by the government have been incessantly questioned as to whether they are reasonable or not. This is an issue faced not only by the government and the operators but by the transport users as well, considering that the decision to be arrived at should strike a balance between the price and quality of services accorded to the transport users and the level of profitability afforded to the transport investors to enable them to continuously provide services. And an important aspect of these regulatory and profitability issues is the determination of the cost of public transport investment and operations.

The objectives of the study based on the aforementioned background, are the following:

a) To understand the cost structure of bus and jeepney industries in Metro Manila;
b) To compare the cost characteristics of bus and jeepney modes;
c) To develop a cost model for bus and jeepney modes; and,
d) To formulate general policy recommendations related to the cost aspects of public transport regulation and management.

1.2 Significance of the Study

The findings of this research can be used as a basis or guide in formulating decisions or policies on:

a) Resource Allocation
Cost models can help answer the question on economies of scale. Awareness of such information would give an idea or assessment of the present undertaking and relating these findings with other transport indicators such as ridership and the present level of service would help in coming up with some recommendations that would encourage the improvement of the existing system.

b) Measures of Productivity
Cost models could indicate what particular areas of public transport operations significantly affects total system cost. This could be done by relating cost with transport productivity variables such as kilometer-run, revenue, number of passengers and others. And this would result to the identification of specific areas of operation that significantly influence public transport cost for a particular productivity gain.

1.3 Scope and Limitations

The focus of this research is on bus and jeepney routes plying the thoroughfares of Metro Manila. The metropolitan area as shown in Figure 1, includes the cities of Manila, Kalookan, Mandaluyong, Pasig, Pasay and Makati and the municipalities of San Juan, Marikina, Valenzuela, Taguig and Las Pinas. The research covers only financial cost. It does not deal with costs of externalities created by transit operations, such as air pollution and delays due to congestion.

2. PUBLIC TRANSPORT SYSTEMS IN METRO MANILA

2.1 Overview on Metro Manila's Transport Systems

Public transport in Metro Manila is dominated by road-based systems, such as jeepneys, buses, taxis and tricycles. Rail-based systems such as the light rail transit and commuter train system, are also in place but they have very low ridership because of their limited coverage.

Table 1 shows the transport demand distribution of daily person trips among the different transport modes. The jeepney has the highest mode share of 55% while the bus has 15% share. The private vehicle has a 30% share while rail-based systems, the Light Rail Transit (LRT) and the Philippine National Railways (PNR) commuter train have relatively insignificant share.

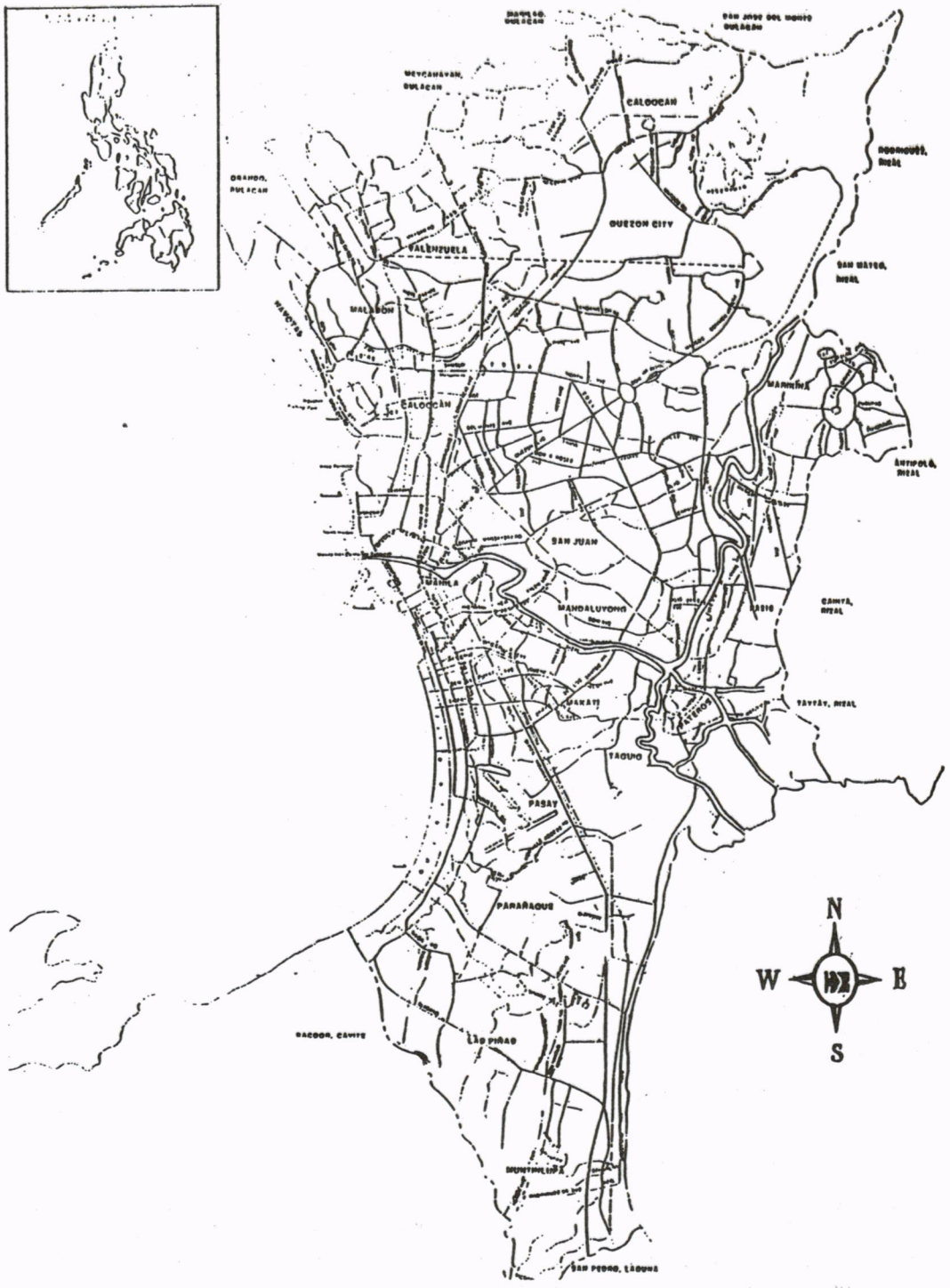

Figure 1 Map of Metro Manila

Table 1 Transport Demand by Mode Share

Year	1974	1980	1985	1989
Daily Person Trips in millions	8.33	10.97	13.08	16.30
Mode Share,%				
Private Vehicle	37.40	25.60	27.50	35.20
Bus	16.40	15.80	15.60	14.60
Jeepney	46.10	58.50	56.50	49.40
Commuter Train	0.10	0.10	-	-
Light Rail Transit	-	-	0.40	0.80
Mode Share, in millions				
Private Vehicle	3.12	2.81	3.60	5.74
Bus	1.37	1.73	2.04	2.38
Jeepney	3.84	6.42	7.39	8.05
Commuter Train	0.01	0.01	-	-
Light Rail Transit	-	-	0.05	0.13

Source: Databook on Philippine Transportation. A compilation prepared by NCTS, May 1993

2.2 The Regulatory System

2.2.1 Route Franchising and Fare Regulation System

The Land Transportation Franchising and Regulatory Board (LTFRB) is responsible for the regulation and issuance of franchise to public utility vehicles. A Certificate of Public Convenience (CPC), an authorization issued by the LTFRB for the operation of land-based public transportation utilities must first be obtained before an operator can provide transport services. This certificate could be issued only upon submission of the requirements as provided in the Public Service Act 146, and approved by the Board. The whole process normally takes sixty (60) days.

With regards to fare regulation, the Department of Transportation and Communications (DOTC) on March 30, 1992 issued Department Order No. 92-587 defining the policies governing transport services which includes liberalization and deregulation. This policy is aimed at enhancing competition in order to improve the quality of public transport service.

The implementing guidelines of the said order was issued by LTFRB through Memorandum Circular Number 92-009. This circular defined the policy framework for the regulation of transportation services and one of the subjects was fare setting. It was provided in the memorandum that control in pricing of transport services shall be liberalized and that no fare adjustments shall be made unless authorized or approved through public hearings conducted by the Board. The widening of the fare range within an indicative or reference rate for bus and jeepney operations was also provided as well as the fare system for air-conditioned buses.

The Supreme Court however ruled out that these orders as applied to provincial buses be nullified (Pablo, 1994). For Metro Manila ordinary buses and jeepneys, the fare structure is shown in Table 2.

Table 2 Fares for Metro Manila Buses and Jeepneys
(in Philippine Pesos)

Effectivity Date	Class	First Four (4) Kilometer	Per Succeeding Kilometer
1986 Jan 26	OB/JP	0.95	0.27
1986 Mar 22	OB/JP	0.90	0.25
1987 Sep 14	OB/JP	1.00	0.27
1988 Nov 14	OB	0.75	0.25
	JP	0.75	0.24
1989 Dec 04	OB	1.00	0.315
	JP	1.00	0.30
1990 Sep 25	OB	1.25	0.37
	JP	1.25	0.355
1990 Dec 08 to present	OB	1.50	0.415
	JP	1.50	0.37

Source: Databook on Philippine Transportation. A compilation by National Center for Transportation Studies (NCTS), May 1993

Note: OB - refers to ordinary buses; JP - refers to jeepneys

2.2.2 Recent Deregulation Initiatives

The above-mentioned department order of the DOTC also defined the policies on the regulation of transport services. In line with this order, the LTFRB and other attached agencies under the department issued their respective implementing guidelines in a memorandum with a common objective of having a viable, efficient and dependable transportation system. The LTFRB's memorandum in particular provided guidelines not only for fare regulation but also for the liberalization of entry into public land transportation services.

2.3 The Bus Industry

The launching of the tranvia, a single horse-drawn tramcar on permanent ways that seated 12 passengers, in 1885 by compania de los Tranvias de Filipinas started the public transportation in Metro Manila. It was later converted into an electric rail by the Manila Electric Railroad & Light Company (MERALCO) in 1903 (Dans, 1987). The autobus was also introduced in 1927 also by MERALCO to complement the services of the tranvia. These systems were proven to be viable until they were totally damaged during the liberation of Manila in 1945.

Bus operations were later revived in 1946 by MERALCO and Halili Transit by importing buses (Iwata, 1993). The government established Metropolitan Transportation (METRAN) to augment the bus system. But because of the stiff competition within the bus industry

itself and the growing number of jeepneys, METRAN went out of business with barely 14 months of existence.

In 1974, the government created the Metro Manila Transit Corporation (MMTC) to improve the bus operations in the metropolitan area. And also, several bus operators were merged into a consortia with the intention of improving bus operations efficiency in 1980. However, they claimed losses and many were forced to return their units (Iwata, 1993). The failure of the bus consortia was attributed to the following:

a) Inadequate fare structure to cover increasing cost;
b) Stiff competition with the jeepneys; and,
c) Maintenance costs being charged by government -accredited contractors continuously siphoned out their finances.

2.3.1 Scale and Market Share of Bus Operators

Urban bus operators are carried by approximately 381 bus companies in 1994. Records from the LTFRB indicate that 273 companies with a fleet size of at most ten (10) units is approximately 73% of the total number of companies. A scale-based classification of theses companies is as follows:

a) 10 units and below	72.4%	276 companies
b) 11 to 25 units	10.8%	41 companies
c) 26 up to and including 50 units	6.8%	26 companies
d) 51 up to and including 100 units	6.0%	23 companies
e) more than 100 units	3.1%	12 companies

These large operators (Fleetsize > 100 units) control approximately thirty four (34%) percent of the total number of vehicles while those companies with a fleet size of ten units at most control about forty three (43%) percent. However, all of these units constitute a very minimal share (1.0%) on the total number of vehicles registered in Metro Manila.

2.3.2 Policies Related to Procurement of New and Used Buses

Executive Order Number 354 issued on March 29, 1989 reopened the bus importation program known as "Bus Installment Procurement Program" (BIPP). Its objective was to beef up the number of public utility buses in Metro Manila.

Used buses or second-hand buses refer to used completely built-up (CBU) passenger buses with rated gross vehicle weight (GVW) greater than 12 tons, and of models which are not more than 10 years old.

Under the program, MMTC was tasked to managed its implementation. The corporation purchased the bus units and offered them for installment-purchase to qualified operators on a tax-free basis.

Only qualified franchise holders of public transport buses duly registered with the LTFRB were allowed to participate and whose qualifications was defined in the Executive Order Number 354.

2.3.3 Problems the Industry

Aside from the competition imposed by other modes, there are other problems being encountered by bus operators which were presented during the First General Conference of the Confederation of Land Transport Operators of the Philippines (COLTOP) in October 10, 1994. They are summarized as follows:

a) Existence of colorum vehicles;
b) Enforcement of traffic rules;
c) High cost of brand new buses and spare parts;
d) Safety
e) Traffic congestion; and,
f) Impossibility of complying with air pollution standards.

2.4 The Jeepney Industry

The jeepney was born out of the American throwaways and Filipino ingenuity, after the Liberation of Manila (Dans, 1987). It has since evolved into a major mode of transportation in the country. The popularity of this mode could be attributed to its:

a) Local availability - manufacturing technology is readily available;
b) Intermediate size or capacity - compatible to most of Metro Manila's road network and configuration; and,
c) Accessibility - provides services at practically any time of the day and place that equates to an almost door-to-door services.

These factors eventually led to the unprecedented growth of the jeepney industry as shown in Figure II. In 1994, the jeepney industry accounted for 40% of total vehicles registered in Metro Manila. Presently, there are over 350,000 units plying the Metro Manila routes (Sevilla, 1994).

But its popularity has given rise to many problems as follows:

a) Presence of colorum or unauthorized units that compete with legally registered vehicles;
b) High level of air polluting emissions;
c) Proliferation of backyard manufacturers whose products are considered quite unsafe;
d) Inconsistent enforcement of traffic rules and regulations which further aggravates the problem on driver's behavior such as improper loading and unloading and imprudent driving.

These are only some of the problems that prompted some sectors to clamor for the jeeepney's gradual phase-out or relegation to secondary or tertiary routes.

2.5 The Light Rail Transit System

The Metro Manila Light Rail Transit Line No. 1 started operations in 1985. It was introduced to alleviate our transportation problems. However, due to its restricted coverage, ridership share is very limited as shown in Table 1.

The LRT Line 1 has a total length of fifteen (15) kilometers that stretches from Monumento in Kalookan City to Baclaran in Paranaque. The line has fifteen (15) stations interspersed that cater and a total capacity of 18,000 passengers per direction per hour.

2.6 The Philippine National Railways (PNR) Commuter Train

The PNR commuter train or Metrotren was introduced in 1989 as an answer to the worsening traffic congestion problem. Presently, there are six (6) existing commuter lines namely: a) Tayuman Station- Alabang, Paranaque; b) Tayuman Station - General Mariano Alvarez (GMA), Cavite; c) Manila - GMA - Kalookan; d) Kalookan - Alabang - GMA; e) Kalookan - Calamba; and f) Alabang - Meycauayan, Bulacan - Tayuman Station. This system reportedly carried an average daily passenger traffic of 13,718 in 1994.

3. DATA COLLECTION AND ANALYSIS

A list of bus operators was obtained from the LTFRB. The operators were ranked and grouped according to their from which samples were purposively drawn. These samples were subjected to an interview with the aid of an interview guide.

For the jeepney part, the data used was taken from the Jeepney Operations Interview Survey conducted by the then Ministry of Transportation and Communications (MOTC) as part of the study entitled Financial Assessment of Jeepney Operations. The study was undertaken jointly by systems and Management Dynamics Inc. and the MOTC in 1985.

4. COST CHARACTERISTICS

4.1 Bus Transport System

The total cost borne by transport operators is broken down as follows:

a) Operating cost;
b) Maintenance cost;
c) Administration cost; and,
d) Fixed cost.

As shown in Figure II, operating costs have the highest percentage share of 62.3% followed by maintenance costs which have 23.4% and administration costs which have 3.6% share.

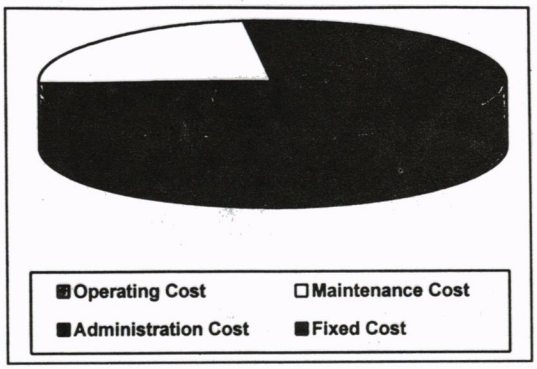

Figure II Total Cost

Operating, maintenance and administration costs were further broken down into their sub-components to get an idea about the likely predictors for the cost modeling.

4.1.1 Operating Cost

For operating cost shown in Figure III, survey results showed that wages for the bus crews have the highest percentage share at 51.9%, followed by fuel cost at 44.8%, and then by staff wages at 3.3%. Bus crew and staff wages were separated due to differences in pay scheme. The crews are commissioned-based in contrast to the fixed-rate scheme of the staff.

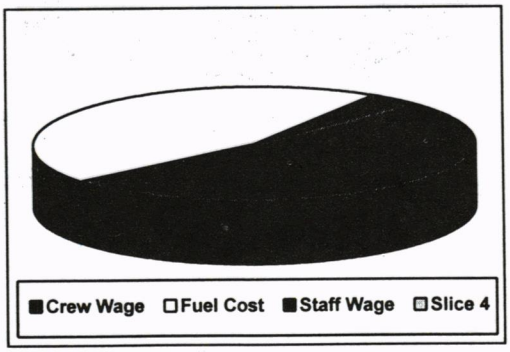

Figure III Operating Cost

4.1.2 Maintenance Cost

As indicated in Figure IV, spare parts costs have the highest percentage share of 65.1%; rehabilitation costs have 22.2% while staff wages have 12.7% share. Rehabilitation cost was included because there are companies which contract out overhauling and heavy repairs so as not to hamper their daily maintenance activities.

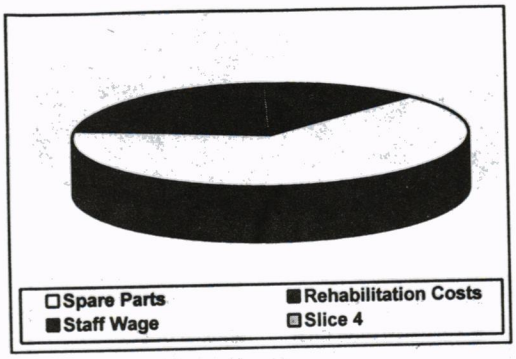

Figure IV Maintenance Cost

4.1.3 Administration Cost

Administration costs include personnel and staff wages, consumable cost, and building, terminal, garage rentals. Wages comprise an 81.8% share, rentals have 9.4% share and consumable costs have 8.8% share.

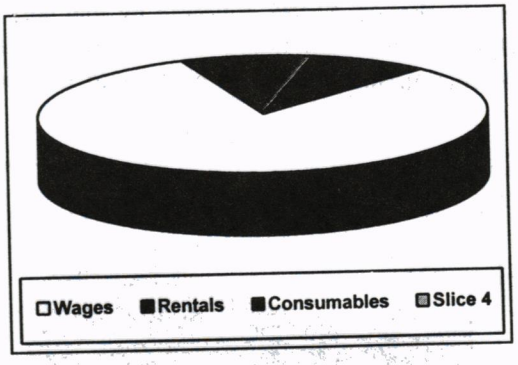

Figure V Administration Cost

4.1.4 Fixed Cost

Fixed cost includes depreciation cost for both vehicle and equipment, insurance, franchise fees, acquisition cost, and taxes. As shown in Figure VI, acquisition cost has the highest percentage share of 54.2%, depreciation cost has 44.6%, while insurance and other fees have a total share of 1.1%.

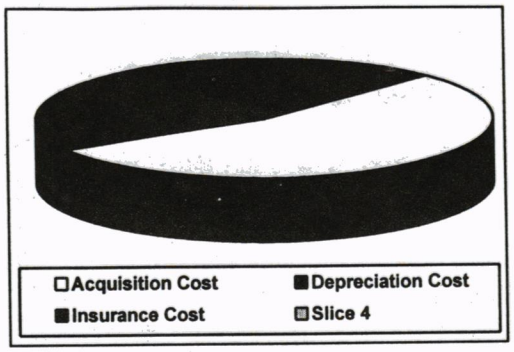

Figure VI Fixed Cost

4.2 The Jeepney Transport System

The total cost of providing jeepney transport services is not so complex as that of the bus. Given that a jeepney unit has adequate fuel and mechanically fit, a driver can readily ply his route. and since operators usually own only one unit, administration is quite simple and thus does not entail any cost for it. The total cost of jeepney operations maybe broken down into the following components:

a) Operating cost;
b) Maintenance cost; and,
c) Fixed cost.

From Figure VII, operating cost has a very high percentage share of 91.2%, maintenance cost has a very minimal share of 7% so with fixed cost having a 1.8% share.

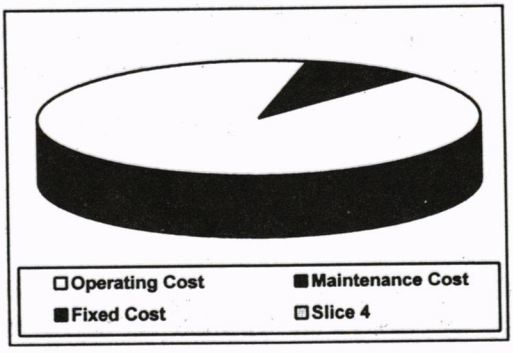

Figure VII Total Cost

4.2.1 Operating Cost

Figure VIII shows the structure of jeepney operations, driver's wage has 66.1 % share while fuel cost has 35.7% share. Maintenance costs incurred while the vehicle is in transit was considered under this category which include tires cost, oil and other repairs.

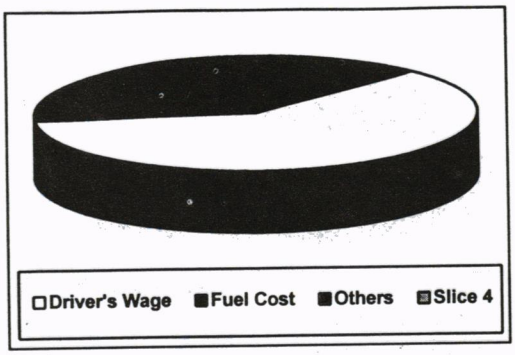

Figure VIII Operating Cost

4.2.2 Maintenance Cost

Maintenance cost includes cost of vehicle repairs which comprise tires, oil and repairs. The cost of labor was not specified in the summary report of the JOS. As shown in Figure IX, cost of repairs is 48.3%; cost of tires is 28.4%; and that for oil is 23.3%.

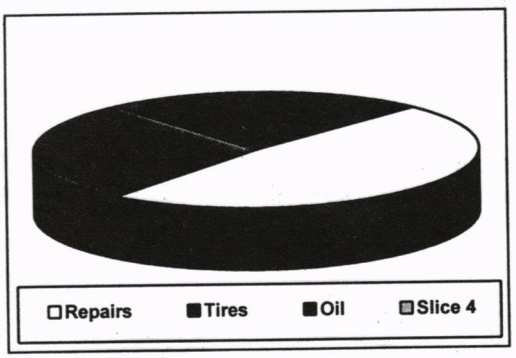

Figure IX Maintenance Cost

4.2.3 Fixed Cost

Fixed cost in jeepney operations includes licensing fees, registration fees and other taxes. Theses items comprise 57% (see Figure X), while the remaining 43% account for other cost, like fees being paid by unregistered jeepney operators to the authorized franchise holders. This practice is popularly known as the "kabit system".

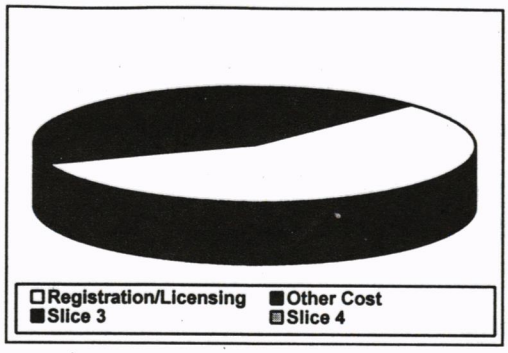

Figure X Fixed Cost

5. COST MODELS

5.1 Bus Sector

The resulting models of this study were developed in validation of Nelson's cost model which is as follows:

$$\ln C = \delta_0 + \delta_1 \ln B + \delta_2 \ln w + \delta_3 \ln VEL + \delta_4 A + \delta_5 S + \delta_6 PUB + \delta_7 s \quad (1)$$

And, this was done through multiple regression analysis technique by utilizing Statistical Analysis Software (SAS) as a tool.

After several manipulations, two models came out to be statistically significant and they are as follows:

1) ln Total Cost = 0.799 + 0.8565 ln B - 0.3492 ln BH (2)
2) ln Total Cost = 2.473 + 0.6091 ln B + 0.2418 ln F (3)

where;

B = total bus-kilometer
BH = bus-kilometer per bus-hour (average speed)
F = fuel cost

The first model was significant with an F-value 0f 13.73, r-square of 0.6176, a p-value of 0.0003, while the significance of the second model is indicated by an F-value of 25.202, r-square of 0.7369, and p-value of 0.0001.

Using reference equation by Berndt (1990), the models show a positive economies of scale in bus operations in Metro Manila. The second model also indicates the significance of fuel cost. It implies that a 100% increase in total cost would approximately increase fuel cost by 24%.

5.2 Jeepney Sector

Following similar procedure used for the bus sector, two models for the jeepney transport system also came out to be statistically significant. They are as follows:

1) ln Total Cost = 2.473 + 0.5815 ln F (4)
2) ln Total Cost = 1.735 + 0.728 ln D (5)

where;

F = fuel cost
D = driver's wage

The first model for the jeepney mode is significant with a p-value of 0.0001, and F-value of 39.725 at 49 degrees of freedom. For this model, fuel cost is the significant explanatory variable.

The second model is significant with a p-value of 0.0001, and F-value of 78.485 at 49 degrees of freedom. Driver's wage or income is the significant variable.

5.3 Findings from the Cost Models

The total cost model analysis for the bus mode indicated the following:

1) A 100% increase in bus-kilometer would approximately increase total cost by 84%;
2) A 100% increase in fuel cost would approximately increase total cost by 24%;
3) Average speed is negatively correlated to total cost; and,
4) Positive economies of scale is present in Metro Manila.

The total cost model for the jeepney mode indicated the following:

1) A 100% increase in driver's wage would approximately increase total cost by 73%;
2) A 100% increase in fuel cost would approximately increase total cost by 58%; and,
3) The analysis on economies of scale showed inconclusive results. However, there are indications, that there may be no economies of scale in jeepney operations.

6. SUMMARY AND CONCLUSIONS

6.1 Bus Industry

The bus industry controls an approximate share of 15% of the total daily person trips in Metro Manila. There are 3,861 authorized bus units in 1994 which represents only 1.0% of the total registered vehicles in the metropolitan area. And also, the industry is dominated by small companies.

The costs structure of bus operations revealed that a large portion is spent on operating cost which is 62.3%, followed by maintenance cost which comprises 23.$%, then by fixed cost which is 10.6% while administration cost has 3.6% share.

Operating cost was further broken down into crew wages with 51.9%; fuel cost with 44.8%; and operating staff wages with 3.6%.

Maintenance cost was also broken down into its sub-components with their corresponding percentage share as follows: a) maintenance cost with 65.1%; b) maintenance staff wages with 12.7%; and c) rehabilitation cost has 22.2% share.
The item for fixed costs are: a) acquisition cost with 54.2%; b) depreciation cost with 44.6%; and c) insurance and franchise fees with 1.1% share.

Administration costs were itemized into: a) personnel cost with 81.8%; b) rentals with 9.4% share; and, c) consumable cost with 8.8% share.

The final cost models for the bus mode are as follows:

$$1)\ \ln \text{Total Cost} = 4.799 + 0.8565 \ln B - 0.3492 \ln BH \quad (2)$$

$$2)\ \ln \text{Total Cost} = 2.473 + 0.6091 \ln B + 0.2418 \ln F \quad (3)$$

where;

B = total bus-kilometer
BH = bus-kilometer per bus-hour (average speed)
F = fuel cost

The cost models developed indicated that a 100% increase in bus-kilometer would approximately increase total cost by 84%. And increasing fuel cost by 100% would increase total cost by approximately 24% also, while average speed is negatively correlated to total cost.

The models indicated the significance of total distance traversed for the day and average speed on the total cost borne by the operators. And based on the model's parameter estimates the presence of economies of scale was deduced. Relating these findings with the current condition of the bus transport system, there is definitely a need to improve the turn around time of public utility vehicles because it affects fuel consumption and the system's productivity.

6.2 Jeepney Industry

This mode of transport has an approximate share of 55% of the total daily person trips. And that, there are about 350,000 jeepney units that are plying the major and minor routes of the metropolitan area in 1994.

The cost structure of jeepney operations showed that a large portion is spent on operating costs which comprise 91.2%.

Itemizing operating cost further, it was found out that driver's wage accounts for a 61.1% share, while fuel cost accounts for a 35.7% share. Maintenance cost for jeepney operations is relatively minimal in comparison with operating cost which include tire cost, oil cost and other repair costs.

The jeepney cost models:

1) ln Total Cost = 2.473 + 0.5815 ln F (4)
2) ln Total Cost = 1.735 + 0.728 ln D (5)

where;

F = fuel cost
D = driver's wage

The cost models show that a 100% increase in driver's income would approximately increase total cost by 73%. And increasing fuel cost by 100% increase would approximately increase total cost by 58%. No conclusive statistical results were found regarding economies of scale. However, given our understanding of the cost structure of jeepney modes it appears that there may be no economies of scale in jeepney operations.

7. RECOMMENDATIONS

Based on these findings, the government should encourage the growth of large bus companies. On the other hand, from a cost perspective, there is no need to regulate the size of jeepney route associations. And also, there is a definite need to improve the turn around time of public utility vehicles for it significantly affects fuel consumption which is a large component of bus and jeepney operating costs. Lastly, due to the difficulty encountered in collecting data for this research, the government should require bus and jeepney owners to periodically submit basic financial reports as a condition for the grant of CPC's. This way, the government can have a better basis for making regulatory policies.

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