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HEAVIER GOODS VEHICLES - A BEHAVIOURAL APPROACH TO COSTING AND RATE SETTING

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HEAVIER GOODS VEHICLES - A BEHAVIOURAL

APPROACH TO COSTING AND RATE SETTING

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ABSTRACT.

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The debates which foreshadowed the introduction of the 38 tonne vehicle in May 1983 focused on two main issues; the environmental effects and the financial effects. Whilst it is recognised that there are many problems with evaluating the former, it is usually assumed that the latter are well documented and, therefore, easily enumerated. This thesis illustrates that this is not so. Costs are calculated using deficient published tables of operating costs and are based on the assumption that operators make wholly rational decisions based on a full knowledge of their total costs. The use of these assumptions can result in misleading conclusions.

Following from this, the objectives of this research are threefold; to analyse operators' methods and approaches to costing and pricing and the importance of costs in their decisions; to investigate the factors which influence the detail of costing; and to develop a quantitative model of the determination of operators' perceived costs. The achievement of these objectives will allow a more accurate and thorough understanding of the reactions of operators to changes in legislation.

A conceptual and operational model is proposed based on the behavioural theory of the firm and observations of operators. It is found that the majority of operators do very limited costings and attach little importance to them. Factors which influence the level of costing are the type of operator, whether other operators' costs and rates are monitored, whether budgets are used and the geographical coverage of the operator. A great deal of general support for behavioural theory is obtained, although it is shown that the theory cannot be used to explain costs statistically. Only one behavioural variable, use of budgets, is shown to be a significant determinant of costs. Other significant variables are; type of firm, carrying capacity of the vehicle, size of firm, geographical coverage and whether costs are calculated.

ACKNOWLEDGEMENTS

CONTENTS

CHAPTER 6.   PRELIMINARY TESTING OF THE MODEL RELATING
BEHAVIOURAL   THEORY TO COSTS AND PRICES.   RESULTS FROM
A SURVEY OF THE SAME 18 FIRMS.

CHAPTER 7.   STATISTICAL   DETERMINATION OF COSTS AND
THE   INFLUENCES ON COSTING   APPROACHES   OF   OPERATORS.
RESULTS FROM A LARGE SCALE SURVEY OF 2340 OPERATORS.

CHAPTER 8.   DISCUSSION,   CONCLUSIONS   AND   SCOPE FOR
FURTHER WORK.

APPENDICES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Background and value of research

Road freight transport is of tremendous importance to the economy of the UK with expenditure on it amounting to £21400m in 1984 (HMSO 1986a). This compared with £5457m public expenditure on law and order and £1315m consumers' expenditure on clothing and footwear (HMSO 1986b). Road freight transport also has a huge impact on society. In 1984 there were over 440000 goods vehicles registered in the UK and nearly 10000 of these exceeded 25 tonnes gross vehicle weight (GVW). These 440000 vehicles travelled a total of 16404m km in the UK alone and lifted 1319m tonnes of goods (CSRGT 1986). Thus wherever they are located in the UK, no-one can escape the presence of the heavy goods vehicle.

Because of the significance of the industry, it is important that its full costs can be evaluated so that those people responsible for policy decision making affecting the industry (legislators and academics in particular), can make their decisions based on a full knowledge of such costs. Costs in this respect must include both environmental and financial costs.

At present, important policy decisions which can affect

the very fabric of society (employment, location of industry and the environment being but three areas directly affected by such decisions), are usually based on grossly deficient sources of cost information which purport to show the objective costs of operating (see Chapter 2). Furthermore, evaluations are based on the assumption that operators make totally rational decisions based on a knowledge of their (assumed) known costs. The problem with this is that there is a difference between operators' actual and perceived costs. For many policy decisions it is not the actual or objective costs as sought by the evaluators that are important. It is far more important to know operators' perceived costs as it is these which determine operators' reactions to changes in policies and thus the <u>actual</u> outcome of the policy decisions.

Take, for example, the introduction of the 38 tonne vehicle which was allowed on the roads of the UK from May 1983 following the Report of the Armitage Committee (1980). The effect of their introduction depends on their usage which is determined firstly by the number of 38 tonners purchased or converted from 32.5 tonners and secondly by the use to which they are put once purchased. These in turn depend on operators' perceptions of the relative economic and operational advantages of the 38 tonner. It is, therefore, operators' whole approach to costing as well as their perceived costs which need to be investigated for it is these factors which determine their behaviour. The former includes the importance attached to costs by

2

operators in their decision making processes, the methods
used to calculate costs and the level of detail of costing
done.

Take another example, that of the imposition of heavy
lorry bans in London as debated by the GLC and considered
by the Wood Inquiry (1983). Operators' reactions to the
lorry bans are not so much determined by the actual
financial consequences of the bans and the relative costs
of the alternative courses of action open to them, but by
their perceptions of the financial consequences. They
will choose the course of action which has the lowest
perceived costs. The actual costs (if these can ever be
measured) are practically irrelevant because they are not
an important determinant of their behaviour, except at the
bottom line. How they calculate costs, what their
perceived costs are and the importance attached to costs
are the primary determinants of operators' actions.

Conclusions reached by policy makers at present are, thus,
based on inappropriate and unjustifiable foundations. Only
with a knowledge of these other factors referred to above
can operators' reactions to changes in existing legislation
or proposed new legislation be realistically considered.
At present little is known of these.

Following from the above, the objectives of this thesis
are threefold.

1.2 <u>Objectives</u>

1) To analyse road freight transport operators' methods and approaches to costing and the importance of costs for operators in the decision making process.

2) To investigate the factors that influence operators' costing and pricing methods.

3) From a descriptive understanding of the approaches to costing, to develop a quantitative model of the determination of operating costs.

The main theme of this thesis is, then, costing and pricing in the road freight transport industry. Throughout the text one other specific issue is frequently addressed; the introduction of the 38 tonne vehicle. This important and topical issue is used merely for illustrative purposes, to clarify and reinforce the arguments contained therein.

1.3. Chapter development.

As stated above, the main theme of this thesis is costing and rate setting in the road freight transport industry. It is often assumed that whilst the environmental costs are very difficult to measure, vehicle operating costs are well documented and, therefore, easily calculated. The purpose of Chapter 2 is to reveal the deficiencies of the present methods of enumerating operating costs and rates and to illustrate how widely used these methods are. It shows that practically all research involving the enumeration of transport costs use published tables of operating costs which are unreliable and inconsistent and which can lead to differing conclusions depending on which particular set of tables are used. The chapter is important because in indicating the problems inherent in the present procedures for cost enumerations, it highlights the need for the research carried out in this project.

Chapters 3 and 4 consider the economic theory of costing and pricing. The aim of this section is to find a theory which is applicable to the costing and pricing approaches of road freight transport operators. This is important since the objectives of the thesis include investigating the factors that influence costing approaches and to discover how costs are determined. Without a theory to indicate the important variables, this would be impossible.

The first theory considered is the oldest and most well established theory, the Neoclassical Economic Theory of the Firm. A brief exposition of the theory is given to convey to the reader the flavour. It is demonstrated that the neoclassical theory often provides the theoretical underpinnings to the literature on road freight transport costs. It is shown, however, that the empirical evidence in the literature is unsupportive of the theory. The fact that supporters of neoclassical economics (loosely termed marginalists), do not accept these empirical findings as refutations of the theory is acknowledged. It is proposed, however, that the Neoclassical Theory of the Firm cannot hold up under the strain of these empirical findings and that, therefore, it has little potential for this thesis.

Chapter 4 considers the relevance of the Behavioural Theory of the Firm as first propounded by the Carnegie School of economists. Again, the chapter starts with a literature review of the theory. The behavioural theory is a theory of the process by which decisions are made. The major premise is that individuals are not globally omniscient, rational human beings, but satisficing beings, limited in what they can do by the information available and their intellectual capacity. Although the theory has never been applied to costing and pricing in road freight transport, its applicability and therefore, its potential to this area is illustrated by reviewing its application to other, related, areas. The chapter concludes by restating the potential of the theory and by proposing a theoretical conceptual model based on it.

Chapters 5, 6 and 7 contain the empirical work. Each chapter covers a different aspect of the research and each builds on the results of the preceding one.

Chapter 5 covers the exploratory study. The aim of this chapter is to investigate operators' methods of and approaches to costing and pricing and to determine whether they were in any way supportive of the behavioural theory of the preceding chapter. The chapter starts by describing the methodology which entailed visits lasting 2-3 days to each of 18 operators with the purpose of observing their operations and interviewing the relevant decision makers. It goes on to describe the results obtained and to discuss them in relation to the behavioural theory. The whole approach to costing and pricing was shown to be very supportive of the behavioural theory; for instance, satisficing was prevalent, operators were adaptive organisms relying to a large extent on standard operating procedures and rules of thumb, they tried to create a negotiated environment and constantly sought to increase available information which then went unused. The chapter concludes by proposing an operational model of the determination of perceived costs based on the behavioural theory and the on-site observations.

Chapter 6 seeks to determine whether there is any preliminary support for the model proposed in the previous

chapter. The research instrument used for this part of the study was a quasi-experimental design in costing and pricing, which was sent to the same 18 operators, together with a questionnaire. The former sought to elicit costs and rates and the latter to obtain data on the model variables. The study was also designed to act as a pilot study for the large scale survey (described in Chapter 7). Examination of the results using cluster and regression analysis demonstrated considerable preliminary support for the model, although because of the small numbers involved, the results were not statistically reliable.

The aims of chapter 7 are to investigate the statistical determination of costs in terms of the structural and behavioural variables of the model proposed in Chapter 5 and to consider the influences on the level of detail of costing done. The research instrument used was a large scale postal questionnaire survey which was sent to a representative sample of operators in two contrasting traffic areas. Analysis of the results commences by confirming the representativeness of the responses. It continues with an examination of the data obtained first on the behavioural and structural variables and secondly on the costs and costing practices, independently. It is shown that despite the importance of calculating costs accurately, in general, operators do very imprecise costings and attach little importance to them. Operators, therefore, cannot make rational decisions based on their costs. It then goes on to relate the costs and costing

practices to the data on the variables, again using cross
tabulation, cluster and regression analysis. Four
variables (type of operator, use of budgets, monitoring of
others' costs and rates and geographical basis) were shown
to influence the level of detail of costing done. The
regression analysis of costs on the independent variables
showed that the latter explains 60% of the variation in
costs. Six variables emerged as significant determinants
of costs; type of operator, carrying capacity of the
vehicle, use of budgets, size of firm, whether costings
were done and geographical base.

The final chapter, chapter 8, is a discussion and
conclusion section which brings together the analysis of
the preceding three chapters and relates it to the theory
of Chapters 3 and 4. It starts by considering the costing
and pricing methods and approaches used by firms and the
factors influencing these. It goes on to consider the
actual determination of costs in terms of the structural
and behavioural variables. The implications of the research
to both operators and policy makers is then discussed. The
chapter concludes by proposing some ideas for further
research.

CHAPTER 2

REVIEW OF THE TREATMENT OF ROAD FREIGHT TRANSPORT

OPERATING COSTS.

2.1. Introduction

The purpose of this chapter is to demonstrate the need for
the research carried out in this thesis. This is achieved
by firstly reviewing the existing sources of information on
goods vehicle operating costs and revealing their
inadequacies and secondly by demonstrating the widespread
use of these unrealistic sources in the cost enumerations
of both academics and legislators.

The chapter starts with a brief consideration of what is
meant by costing. It goes on to consider the deficiencies
of the existing sources of information on operating costs.
Much of the detail on this is contained in a Working Paper
(Hallett and Gray 1985) which is included as Appendix 1.
The text in this chapter contains only a summary of the
major points. The next stage is to illustrate the
dependence of the literature which includes the enumeration
of transport costs, on these inaccurate sources.

2.2. Costing

Costing involves 'the process of identifying, calculating

and recording every item of expenditure incurred in the purchase or hire of goods vehicles, in maintaining them, in running them and in supporting the administrative and management functions necessary to control their use, followed by an analysis of the total operating costs into costs per unit of load distance or time.' (Lowe 1983). The private costs of freight transportation, i.e. the costs borne by the operator, fall into two principal categories; the movement costs and the terminal costs (Button and Pearman 1981). Movement costs, as the term suggests, are those costs incurred in the actual transportation of the freight on the lorry to its destination point. Movement costs are usually divided into two groups, running costs and standing costs, or fixed costs. Running costs are those costs which vary with mileage, whilst standing costs are those costs which are not mileage related but time related.

Roudier (1976) further subdivides running costs into costs which vary as a function of (a) extraneous factors such as the general traffic speeds and the distribution of consignees' premises and (b) internal factors such as the type of vehicle, the load factors and the composition of the fleet. The first group of costs are often ignored, or at least, assumed to be constant due to difficulties in modelling. Yet, as Roudier has found, 'the distribution of a single ton of groceries to a number of small grocers in the Paris area costs more than their carriage by road in 20 tonne lots from Marseille to Paris'. Variability of

11

conditions, thus, have a large impact on costs and, therefore, should also be considered.

2.3. Critique of existing sources of information on operating costs.

There is a variety of sources of information on road freight transport operating costs. The four major sources are the tables of operating costs published annually by Commercial Motor (CM), cost tables published quarterly by Motor Transport (MT), the Cost and Rates Service of the Freight Transport Association (FTA) and costs collated by the Road Haulage Association (RHA). They are all, however, deficient in many ways. Some of these deficiencies are illustrated in the following pages.

Published tables of operating costs are based on generalised costs for various types and weights of vehicle (see Hallett and Gray pA3'. All the tables are agreed on a few basic facts; for example, that wages form a large proportion of standing costs per week and that fuel is the most costly component of running costs. The relative magnitudes of these cost elements are apparent in all the operating cost tables. However, neither the absolute values, nor even the cost elements included in the frameworks are the same in any of them.

Consider first the composition of the cost frameworks. CM,

12

for instance, is the only one to include interest as a separate item. This represents the interest payable on the money borrowed to purchase the vehicle, or alternatively, if the vehicle was purchased from acquired capital, the interest that money could have accumulated if deposited in, say, a bank. CM also includes a rent and rates element as well as adding 20% to operating costs to cover overheads (stated as stationery, telephones and postage, staff salaries, lighting, heating, and other office costs). MT includes an element called 'establishment costs' which is essentially the same as overheads and comprises telephone and mail (10%), administration staff (40%), rent and rates (15%), company cars (20%), light and heat (5%), and financial (10%). FTA and RHA have no items to cover rent and rates, but do include an 'overhead' figure. Depreciation, although included in all tables, is included as a running cost in CM but as a standing cost in the MT, RHA and FTA tables. In reality it will be a mixture of the two, for although a vehicle depreciates in value even if it is never used, it depreciates at a faster rate with increasing mileage. The same thing occurs with wages which MT and CM class as a standing cost and FTA and RHA class on its own.

Turning to the magnitudes of the cost elements included in the published cost tables, Hallett and Gray (p45) show that they differ tremendously between sources. In the 1983 cost tables, for instance, there is a tenfold difference in the insurance costs between the FTA tables and the CM

13

tables and a 60% difference in wages between MT and FTA
tables. Total annual costs for a 32 tonner doing the
average annual mileage of 43700 miles (CSRGT 1983) range
from £32145 in the FTA tables to £44890 in CM; a difference
of nearly 40%.

Although there have been changes in absolute cost figures
since 1983 this has not altered the essence of the
analysis; equally large intertable differences are to be
found in the 1986 tables. The major occurrence since 1983
has been the replacement of the FTA Costs and Rates Service
by the Managers' Guide to Transport (1985), a much more
comprehensive source covering many aspects of transport
including material handling costs and finance as well as
transport costs. The expansion in coverage has, however,
been achieved only at the expense of detail. Costs for
each weight category of vehicle are now given for average
mileage, lower mileage and higher mileage rather than for
different makes of vehicle as before. To their credit, at
least many pages of explanation are given on their method
of calculation - which is more than can be said of the
other sources.

Hallett and Gray show that there are other causes for
concern. These include that in the published tables,
neither working conditions nor traffic conditions are taken
into account. Furthermore, only one cost is given for each
gross weight category of vehicle when it is widely

recognised that vehicles of different makes but with the same GVW can have widely differing costs. Also, capacity utilisation is rarely taken into account and when it is, it is done incorrectly.

One of the worst problems associated with these cost tables is that the sources of information are rarely detailed, and when they are, they are shown to be rather dubious in nature. Most of the tables make statements such as "the fuel cost is taken as a typical pump price" (MT) or "tyre costs are the price of a set of tyres for each vehicle divided by its tyre life in miles" (MT). How the typical pump price or the normal tyre life is arrived at, is unspecified.

The 1983/84 edition of CM states "These cost tables are constructed on base costs which apply throughout the industry and national averages where the cost varies between areas". Nothing is said, however, about their actual sources of information. In the 1985/86 edition a new category of vehicle costs was introduced for drawbar combinations. The source of this information was stated as "manufacturers and a cross-section of operators engaged on a variety of operations". The actual number constituting the sample and the method used to obtain the sample is not stated.

MT is even less specific stating merely that a "base vehicle is considered for each vehicle category". Again,

how the base vehicle is decided upon or from where the
information for this vehicle is obtained is left
unspecified.

The sources of information for the FTA's Cost and Rates
Service are also unspecified. The 1984 edition says
nothing about the sources except that because of changes in
the data sample, the continuity of the tables is destroyed
- intimating that the source is information from operators.
The RHA tables are collated from information provided by
operators, but their number and types of operation is a
mystery.

Attempts made by the researcher to obtain information on
the sources used met with mixed success. Phone calls were
made to both CM and MT from which it was learned that
formuli were used to calculate costs; the formuli were
closely guarded secrets. A personal visit to the FTA
confirmed that the source of their information was indeed
contributing members, but again the actual number used was
not divulged.

The more recent Manager's Guide to Transport Costs
specifies its source as 66 member operators owning an
unspecified number of vehicles. Based on this sample,
costs of 11 distinct groups of vehicles are given and each
of these is further divided into average, lower and higher

mileage categories. This can scarcely be expected to provide accurate or representative costs.

The above critique is confined to four major sources of operating costs. There have been, and still are, a few other sources of such costs. Probably the most famous was that compiled by Edwards and Bayliss (1968). Edwards and Bayliss did a very detailed analysis of the costs of road freight transport using data from a survey of 4250 operators. Their aim was to establish "total expenditure by road haulage operators during 1965 and the composition of that expenditure with respect to such factors as fleet and vehicle size." Costs were broken down into many constituent parts. The work represented a great step forward but unfortunately was a once only study.

Another such source was a series of studies by Dawson (1962, 1965, 1970, 1972, 1974). These sources concentrated on the social resource costs rather than the private costs of operation. The costs given were intended for use in the assessment of road traffic schemes. Insurance costs, for instance, were excluded because "these cover the costs of accidents which are valued directly in economic assessments". Costs included in the studies were depreciation, time, fuel, tyres, oil and maintenance. They were only calculated for a representative commercial vehicle, which he took to be one with 10 tons carrying capacity, rather than for a whole host of individual vehicle weights.

A more up to date source of information on transport costs
is contained in the annual Survey of Distribution Costs
carried out by the Centre for Physical Distribution
Management (CPDM 1984). It covers the costs of
warehousing, third party storage, own transport, bought in
transport, administration, inventory and other costs. The
transport costs are broken down into drivers, fuel,
maintenance, depreciation, others and third party.
However, unlike the four major sources, they are not given
on a per vehicle basis but in aggregate terms e.g.
transport costs as a percentage of sales. The survey
gained responses from only 67 operators in 1984, so again,
it can hardly be regarded as representative. The low
response can be partially explained by the
questionnaire which is very unclear and starts
by asking respondents to give their Standard Industrial
Classification Number - something a transport manager would
be very unlikely to know.

2.4. The use made of published cost tables.

The very aggregate cost tables appear to be of little
practical use without a great deal of adaptation. In fact,
it is questionable whether they serve any useful purpose.
It would be interesting to know how many firms actually
use them, the extent to which they are adapted and the use
to which they are put. The Price Commission study of 1977

gives some indication of the extent of their use in the setting of charges by hauliers.

TABLE 2.1

PROFESSIONAL HAULIERS' USE OF SOURCES OF INFORMATION IN SETTING CHARGES.

Percentage of respondents making stated degree of use

Source	Frequently	Occasionally	Hardly Ever	Never
RHA	28.3	31.1	12.6	28
FTA	4.4	8.9	5.0	81.7
CM	27.7	33.7	13.9	24.7

Source: Price Commission 1977

Although this source is a little dated, it can be seen that a large proportion of professional hauliers use cost tables in setting charges. The less frequent use of FTA tables can be explained by the fact that the majority of the FTA's membership are own account operators and not professional hauliers.

The use of published tables of operating costs is not confined to hauliers. Because of the lack of credible or comprehensive alternatives, they are used by academics and policy makers alike. Margason and Corcoran (1978) in seeking to evaluate the effects of the heavy vehicle, stated that "so that sound decisions can be made to achieve

an appropriate balance it is necessary to investigate in detail, the nature, magnitude and distribution of all the relevant effects". Yet they used CM tables to enumerate the costs. Battilana (1976) in assessing the costs of using light vehicles for town centre deliveries and collections following the introduction of lorry bans, used CM tables as the basis of evaluation. Because he realised the pitfalls of such tables, the costs were compared with figures taken from MT. He found that "the change to MT tables reduced the estimate of present costs by 13% on average and the average increase in costs was reduced by 26%". Despite the magnitude of the differences, he stated that the margin of difference was acceptable.

In order to fully evaluate the proposed Hull traffic scheme (essentially a heavy lorry ban) and others like it, Wilbur Smith and Associates (1977) set up a computer model. A complicated algorithm to model the affects on the movement of goods and goods vehicles was constructed; yet to enumerate the costs CM figures were input into the programme. This model was then used to analyse the effects of the Swindon freight scheme (Cundill et al 1977) and for further evaluation of the Hull freight scheme (Bartlett et al 1978).

Battilana and Hawthorne (1976) considered the design and cost of a transhipment depot to serve Swindon town centre. Again CM tables were used, although in this case they were slightly modified in the following ways: 1. the allowances

made for drivers wages, rent, rates and overheads were ignored since they were all dealt with separately.

2. the allowance for profit was ignored since a profit margin was added to the total cost of operating the transhipment depot.

3. an allowance was made for the extra costs associated with refrigerated and demountable vehicles.

4. because of the low mileage involved, depreciation was treated as a standing cost as in MT tables.

5. the annual costs were divided by 52 to obtain weekly costs.

Thus some effort was made to overcome the most obvious problems. However, when the alternative sources referred to were considered, it was found that the modification used for drivers wages (modification 1), was the use of advertised appointments and CM tables.

Prudhoe and Christie (1981) looked at the effects of a lorry control in the rural area of Hertfordshire. Their method was as follows; "Increases in the costs of operators who have diverted their vehicles from routes through the central area to routes around the area because of the control were estimated using flow changes: From the changes in distance and time, changes in operating costs

were deduced using data......based mainly on information
supplied by the FTA".

Pike (1982) used CM tables to compare road freight rates
with rail freight rates. The Keynote Report on Road
Haulage (1984) used FTA figures to show that costs rose by
4%-5% in one year. Warner (1985) used FTA figures to show
cost trends and also used them to forecast future costs.

Cooper and Doganis (1982) used MT costs to compare the
costs of demountables against the use of articulated
vehicles, although other costs were used in conjunction
with these. Cooper (1985) used CM tables to show how
retailers have benefited from the use of heavier lorries.
Hall (1982) used CM and MT tables to calculate costs in a
report on planning for road freight by the local
authorities.

Patterson and May (1982) in calculating the impact on
costs of heavy lorry bans in London, used MT as the sole
source of information. The Wood Report into heavy lorry
bans in London (1983) also based its economic evaluations
on MT tables. Despite the importance of the inquiry, it
stated that the reason for using MT tables was "because
these tables are cast in a form which happens to fit more
easily into our own framework of discussion". Accuracy, it
seems, was irrelevant. The only modification made to the
tables, which the report describes as providing 'reliable
information', was that the 20% profit allowance was

replaced by a 10% return on capital.

Newton (1985) studied the trends in road goods transport over the period 1973-1983. This report includes a section on operating costs by class of vehicle and by cost element. This was all based solely on figures from CM. Johnson and Wilding (1986) of the statistics department of the DTp, which considered the early impact of the 38 tonne vehicle and concluded that the increase in GVW from 32.5T to 38T enabled savings of £50m per annum to be made, based on CM figures.

Finally, the result of the debate on the heavier vehicle and the projected savings in operating costs was based on a report by the TRRL (Corcoran et al 1980). The sources of their costs were quite varied and credit must be given to them for this. However for rent, rates and insurance figures used were from CM. The framework used was that of CM — this means the inclusion of interest as an element — and the method used for calculating overheads i.e. adding a fixed percentage to costs previously identified, was the same as CM. Whilst it is quite understandable that the TRRL should have used CM tables because of the lack of better alternatives, the fact remains that had figures from other tables been used, the outcome may have been different. For an average mileage of 36871 (as used by the TRRL) standing costs account for approximately 50% of total annual costs and rent, rates, insurance and interest account for more than 50% of standing costs in CM.

Corcoran et al based their costs on interviews with 33 operators owning 3056 maximum weight 32.5T vehicles. The likely number of heavier lorries of each gross weight category was calculated using the subjective estimates of the operators. The information from this survey was grossed up using official data. Mackie and Harding (1982), however, argued that insufficient account was taken of volume constraints. Corcoran et al used data from firms who were constrained in what they could carry by weight and not by volume. Mackie and Harding found in their survey of 114 operators that only 53% of loads were weight constrained and therefore suitable for transport by heavier lorry. Gray and Hallett (1984) showed that this substantially diminished the benefits.

2.5. Implications

The above analysis has shown that knowledge of goods vehicle operating costs is at a surprisingly elementary level. The extent and consequences of this ignorance can, perhaps, be illustrated most dramatically through the use of an example. The introduction of the heavier lorry provides an obvious example.

One of the major factors influencing the final decision to introduce 38 tonne goods vehicles in the UK in May 1983 was the projected savings in operating costs resulting from the purported economies of scale in the use of heavier lorries. The argument was that although the operating costs of heavier lorries increase with increasing GVW, payload capacity increases at a faster rate resulting in lower costs per tonne of goods carried assuming a fully laden vehicle. It was reckoned by Armitage (1980) that savings of between £120m and £135m per annum would be gained through the change in the weight limits.

Using the published tables of operating costs, however, the relative financial advantages of operating the 38 tonne vehicle as opposed to the 32.5 tonne vehicle are seen to differ quite substantially between tables. Table 2.2 demonstrates this.

TABLE 2.2

VARIATIONS IN ESTIMATIONS OF THE RELATIVE COST ADVANTAGE

OF THE 38 TONNE VEHICLE OVER THE 32.5 TONNE VEHICLE.

	CM	MT	FTA average
Cost per mile (1500 miles)			
32.5T artic	91.7p	83.5p	67.1p
38T artic*	115.1p	92.1p	74.1p
Cost per tonne/mile (1500 miles)			
32.5T artic	4.2p	3.8p	3.1p
38T artic	4.6p	3.7p	3.0p
Percentage difference	10%	2.6%	3.2%
Cost of transporting 1000 tonnes of goods 300 miles using			
32.5T artic	£13009.3	£11918.3	£9034.8
38T artic	£13842	£11181	£8894
Difference	-£832.7	£737.3	£140.8

* 3 axled tractor with 2 axled trailer
Source: Hallett (1984)

Table 2.2 shows that although costs per mile are higher
for a 38 tonner than for a 32.5 tonner in all the tables,
when these costs are divided by the vehicles' respective
carrying capacities (i.e. 25 tonnes and 22 tonnes), costs
per tonne mile are lower in MT and FTA but higher in CM.
CM predict a 10% increase in costs per tonne mile if a 38
tonner is used rather than a 32.5 tonner.

The third part of the table shows what this means by way
of a concrete example taking into account vehicle
indivisibilities.   Suppose an operator needed to transport

26

1000 tonnes of goods 300 miles.   Suppose also that one
lorry can travel 300 miles a day and works a five day week.
Using a 32.5 tonne vehicle with 22 tonne capacity, it would
take 46 journeys, the haulier would travel 1500 miles a
week for 9 weeks and 300 miles in the final week. The cost
of this is compared to what it would cost if he were to use
a 38 tonner with 25 tonne capacity.   In this case he would
travel 1500 miles a week for exactly 8 weeks.   Table 2.2
shows it would cost £832.7 more to use a 38 tonner based on
CM figures, £737.3 less based on MT figures and £140.8 less
according to FTA figures.   This is quite a substantial
variation.   On this basis, the decision on whether to
introduce the 38 tonner is totally dependent on which
tables are used for enumeration purposes.

 The above has shown that the existing sources of operating
costs and the treatment of costs in economic evaluations in
general, leaves much to be desired.   The implications of
this are by no means trivial because the enumeration of
operating costs is the fulcrum around which the arguments
pivot in many transport debates.   There is clearly a need,
then, for research into costing and rate setting in the
road freight transport industry.

CHAPTER 3

NEOCLASSICAL ECONOMIC THEORY OF THE FIRM

3.1 Introduction

The most established theory of costing and pricing in economics is the neoclassical economic theory of the firm. A project concerned with the issues of costing and pricing would be incomplete without a consideration of such theory. The description given below is not meant to be a detailed exposition of the theory; such a task would be immense. It's purpose is to convey the 'flavour' so that the relevance of the theory to the issues of costing and pricing in road freight transport can be established.

The chapter begins with an outline of the theory of production and the derivation of costs in neoclassical economic theory. This is important as it shows the assumptions and conditions underlying the neoclassical cost curves; the basis of so much of neoclassical economics. It then considers the relationship between costs, prices and profit in one particular neoclassical model, namely perfect competition. A summary of the predictions and assumptions of neoclassical economics is given in the third part. Section four analyses the relationship between neoclassical economics and the transport literature to demonstrate the dependence of the latter on the former. A comparison of the theory and practice is made in section five where it is

shown that the empirical evidence does not conform with the predictions of the theory. Finally, section six reconsiders the theory concentrating on the neoclassical defence. It is shown, however, that the neoclassical theory does not provide an adequate explanation of road freight transport costing and pricing and it is suggested that the evidence is supportive of the behavioural theory of the firm as first propounded by the Carnegie School.

3.2 The Neoclassical Theory of the Firm

3.2.1 Production and Costs

The basic objective of the neoclassical firm is to maximise profits which implies that "for any specific output, the firm chooses the least costly way of achieving that output from the alternatives open to it". (Lipsey 1978). The firm is viewed as "a unified acting entity or organism in which input and output decisions are made simultaneously in the light of given product demand information, production technology information and factor supply information". (McGuire 1978). The entrepreneur is thus assumed to be one and the same as the firm. He is assumed to be globally rational in that he possesses all the information he requires on all possible alternative courses of action, is able to evaluate it perfectly and knows all the possible consequences of all the alternatives considered. The internal workings of the firm are

completely ignored.

The principle upon which the entrepreneur works is
marginalism which basically means that "at the beginning of
his undertaking and at every successive stage, the alert
businessman strives to modify his arrangements as to obtain
better results with a given expenditure or equal results
with a less expenditure. In other words, he ceaselessly
applies the principle of substitution with the purpose of
increasing his profits". (Marshall 1936).

The costs of producing any good or service can be divided
into long run costs and short run costs; the length of the
run being determined by the variability of the factors of
production. The short run (SR) is defined as "a period
during which some factors of production are fixed" whereas
the long run (LR) is a "period long enough to permit the
change of all factors of production". (Koutsoyiannis
1979). Thus in the SR firms are able to alter the scale of
their plant and equipment and new firms are unable to
enter the industry. The opposite is true in the LR.
Costs are usually divided into fixed and variable costs.
Fixed costs are those which have to be paid irrespective of
output (e.g. depreciation, licences), and variable costs
are those costs which vary with output (e.g casual labour,
raw materials). In the long run all costs are variable.

The costs of resources in neoclassical economics do not
necessarily equal the expenditure on them. Costs are taken

to be 'opportunity costs' which can be defined as "what the firm must give up in order to obtain the use of a resource". (Lipsey 1978). Thus, if a haulage firm owns the land on which it is located, the cost to the firm of that land is the sum of money that land would obtain if leased to the highest bidder. This means that accounting costs are rarely of any use to the economist; he must instead impute costs to the resources used so that their full economic value is measured.

According to neoclassical economics, a firm's costs are derived directly from the production function for the good or service concerned and the price of inputs. A production function is a purely technical relationship between inputs and outputs. It describes the most technically efficient method of producing any output with a given combination of inputs. A production function can be written

$$q = f(x_1, x_2, x_n)$$

where q = output

$x_1 \ldots x_n$ are the inputs used in the production process.

It assumes that all inputs are measurable, substitutable and infinitely variable and that technology is fixed.

From the production function, a set of isoquant curves can be derived. Each isoquant shows the various efficient

combinations of factors of production that can be used to produce a particular level of output. An infinite number of such curves exist for each good or service.

The minimum cost method of producing any given output is determined by the point of tangency between the isocost line (which shows the relative costs of the inputs) and the isoquant curve. In fig 3.1 this is shown by point (a). With given output x any combination of factors in the shaded area is obtainable but inefficient because fewer factors could be used and thus output could be produced at lower cost. Any point other than (a) on the x curve is also inefficient given the factor prices. Thus there is only one efficient combination of resources for each level of output.

FIGURE 3.1

MINIMUM COST OF PRODUCING A GIVEN OUTPUT
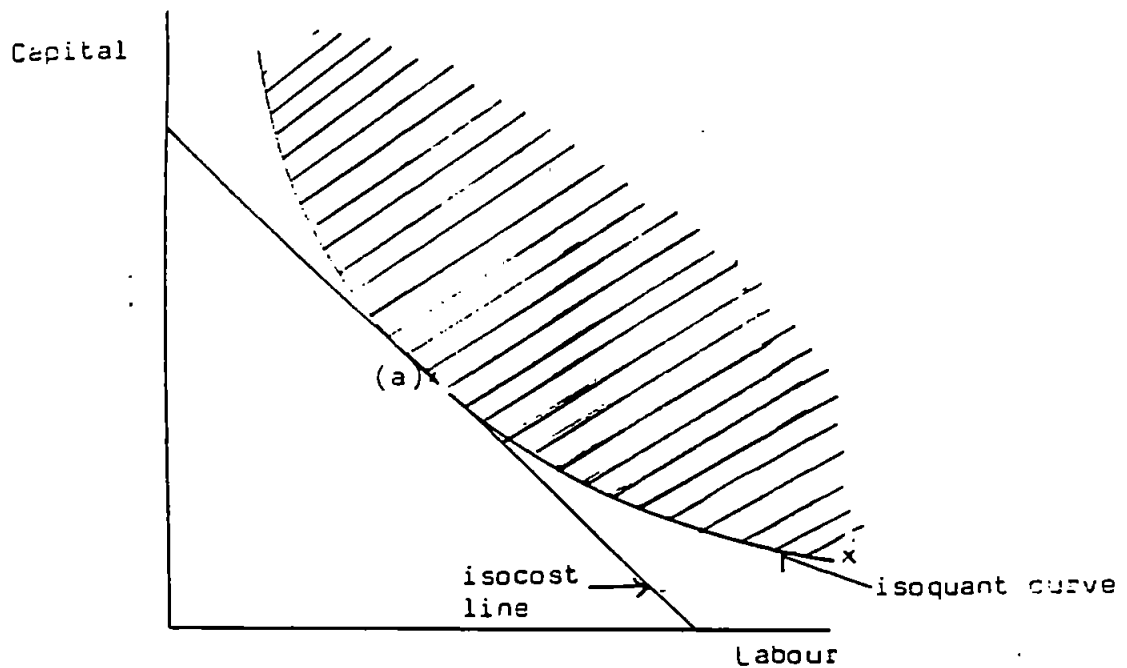
All the points of tangency can be joined to form an expansion path to show the minimum cost method of producing any output of goods or services. From this, the neoclassical cost curves can be derived. A typical set of LR curves are shown in fig 3.2

FIGURE 3.2

TYPICAL SET OF LR COST CURVES
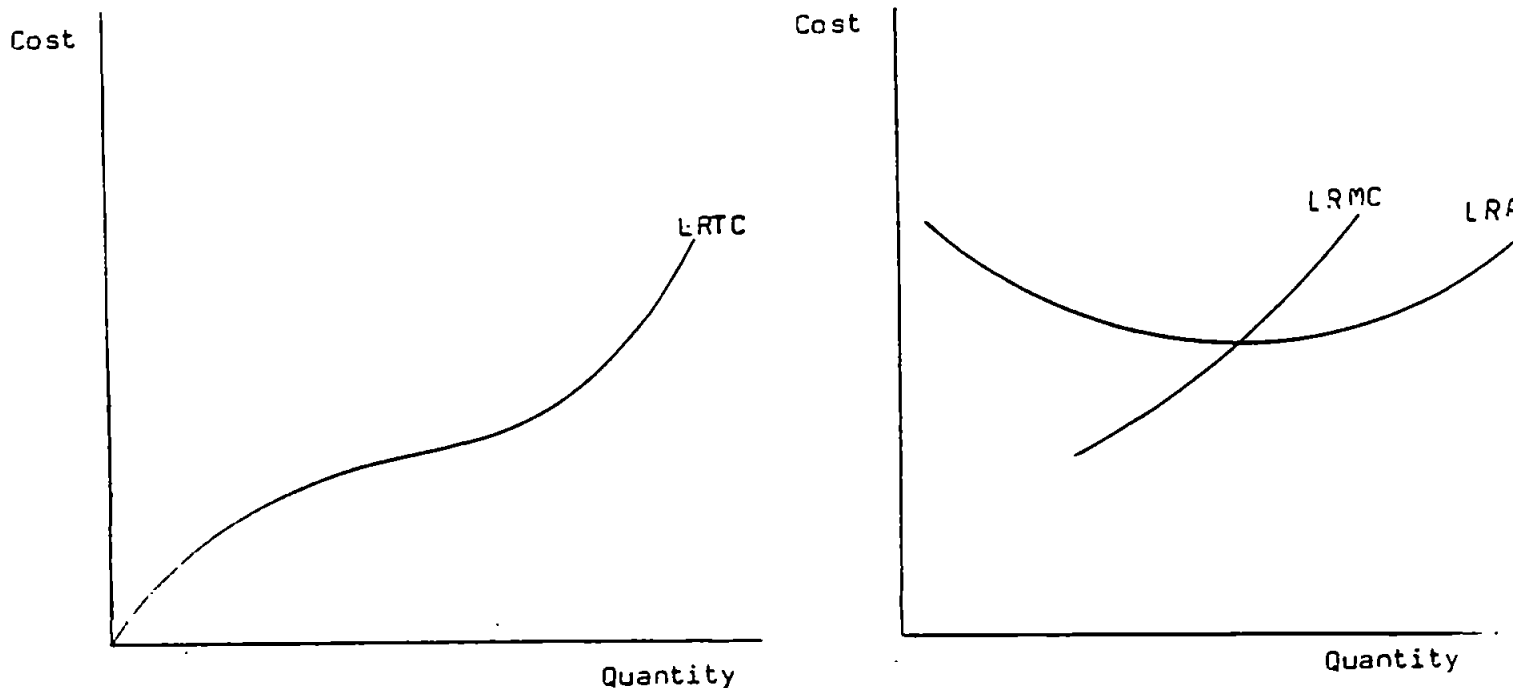
The LR average cost (LRAC) curve is the boundary between what is feasible and what is not, given the production function and the costs of the factors of production. It shows "the least possible cost per unit of producing various outputs when the firm can plan to build any desired size of plant". (Leftwich 1979). The shape of the LRAC curve depends on the existence of internal economies/diseconomies of scale. Economies of scale exist when, say, a doubling of the quantity of inputs produces more than a doubling of output. It has been shown by Bayliss (1971), Edwards and Bayliss (1968), Kritz (1974), Corcoran et al (1980) that economies of scale tend not to exist in the transport sector at the level of the firm, although they do exist at the individual vehicle level i.e.

a doubling of the number of vehicles owned by a firm does
not lead to a less than doubling of the costs, but a
doubling of the GVW of a single vehicle does.

In the long run, the most efficient scale of plant is that
at which the LRAC = SRAC = SRMC = LRMC, that is at the
minimum point on the LRAC curve. At this point, goods
are produced at their minimum cost with the most
technically efficient number and combination of resources.

3.2.2. The Perfect Competition Model

To demonstrate the relationship between costs and prices
in neoclassical economics, consider one particular market
form, that of a perfectly competitive market. This
particular market form is used because freight transport is
often regarded as a good example of a perfectly competitive
market. The necessary and sufficient conditions for the
existence of such a market are:

Sufficient: 1. a large number of firms acting
                 independently

              2. homogeneous and divisible
                 products/services

              3. many buyers so that no one
                 buyer can influence the price

              4. perfect mobility of resources

5. freedom from legal and other non market restraints

6. buyers and sellers are small compared to the size of the market.

Necessary: 1. each firm believes it cannot significantly influence the market price

2. freedom of entry and exit exists.

Kamerschen and Valentine (1981)

Leftwich (1979) adds that supply should be independent of the activities of consumers and demand independent of producers' activities. He also adds that producers and consumers have perfect knowledge. Koutsoyiannis (1979) further adds that the long run consists of a number of identical short run periods which are assumed to be independent of each other.

Thus pure competition is "essentially the idea of smallness of the individual economic unit in relation to the markets in which it operates, the idea of freedom of prices to move in response to changes in demand and supply and the idea that a considerable degree of mobility for both goods and resources exists in the economy". (Leftwich 1979).

The short run model

The firm in a perfectly competitive market faces a
perfectly elastic demand for its product/service; it is a
price taker. It decides on an output given the price
dictated by the market. Since the price is set (usually
assumed by the actions of some kind of Walrasian
auctioneer), the marginal revenue (MR) i.e. the revenue
obtained from the sale of an additional unit of output,
will be constant and equal to the price (or average
revenue). To maximise profits, it must maximise the
difference between total revenue and total costs; in other
words, it must set marginal revenue equal to marginal
costs. This is the important pricing criteria and the
basis of much of neoclassical economics.

Considering fig 3.3, in the SR, with price Po, the perfect
competitor should produce xo units of output. Profits of
pbcd are obtainable. In equilibrium, the firm produces
where MR = AR = MC and uses the most efficient scale of
plant.

FIGURE 3.3

EQUILIBRIUM OF PERFECT COMPETITOR IN THE SR

Cost

MC

AC

Po   b   MR=AR

Xo

Quantity
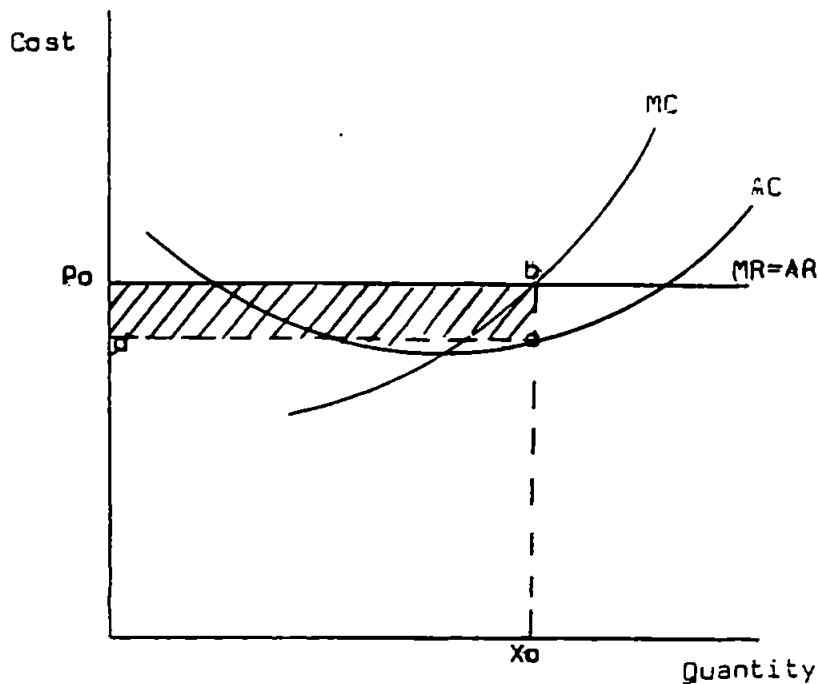
Because of perfectly mobile resources and the existence of perfect information, all firms will have the same cost curves because all have access to the same technology and thus can produce at the same minimum cost per unit. This in turn implies that profits in each firm will be the same. All firms will not, however, be of the same size for as Koutsoyiannis (1979) says "the particular size of each firm in perfect competition depends on the entrepreneurial efficiency of the businessman, which is traditionally considered as a random attribute". The costs will be the same for each firm, however, because of the definition of costs as opportunity costs and not solely accounting costs. The efficient entrepreneur could be hired out to

another firm at a higher price. It is this higher price
that must be taken into account. So as Friedman (1976)
says "If firms differ in size because they use specialised
resources their average costs will all tend to be equal
provided they are properly computed so as to include
rents". The difficulty arises because as Stigler (1963)
states "the accountant refuses to include in costs the
value of the entrepreneur's services in other employments
and insists upon valuing at their historic costs, assets
obtained at bargain prices".

It is not always that a firm is able to make pure economic
profits in the SR. However so long as the firm covers its
AVC it is better to produce the output given by the
equalisation of MC and MR than not to produce any output at
all. Any excess over the AVC can be contributed to AFC,
which have to be paid irrespective of the level of
production. The portion of the MC curve which lies above
the AVC is the supply curve of the firm.

The Long run model

The existence of pure economic profits in the short run
entices entrants into the market in the long run, for by
definition, profits are greater than can be obtained in
other industries. The entrance of new firms, together
with increased production from existing firms, increases

the industry supply. For the additional output to be sold
the price must fall to equate the new supply with demand.
Equilibrium will be reached when the price is driven down
to the point where LRMC = LRMR = LRAC = SRAC = AR, for only
at this position are there no excess profits and therefore
no reason for new firms to enter the market. Each firm is
making 'normal' profits. Whether the new price is the
same, above or below the original price depends on whether
the market is characterised by constant, increasing or
decreasing cost conditions respectively. The firm's long
run equilibrium is shown in fig 3.4.

FIGURE 3.4

EQUILIBRIUM OF PERFECT COMPETITOR IN THE LR
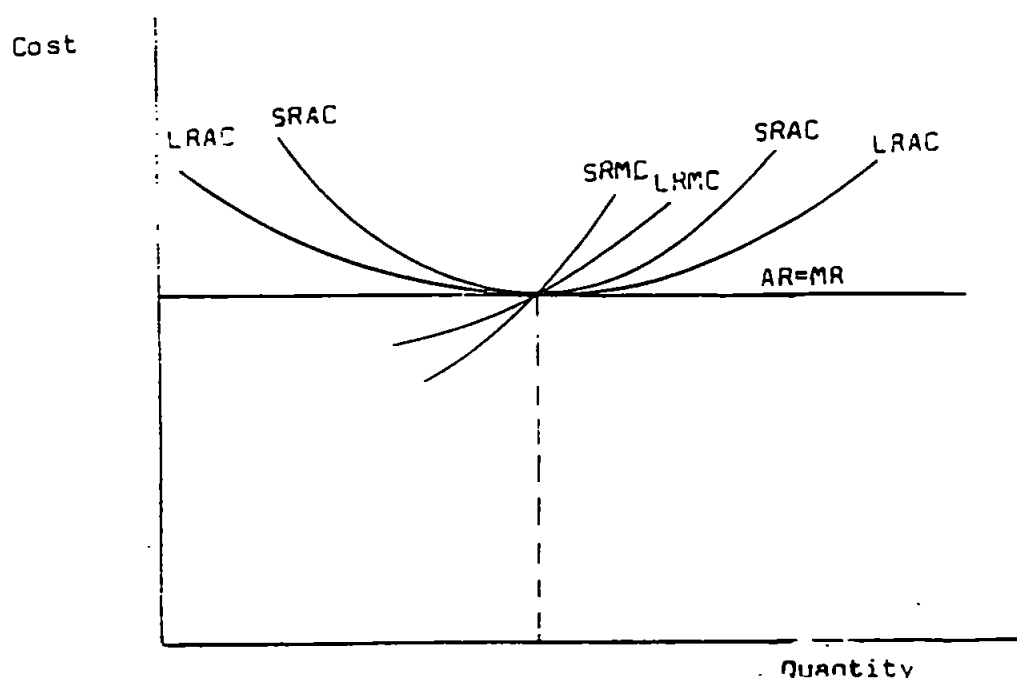
Each firm produces with the most efficient scale of plant
and at the most efficient output. Both consumer and

producer welfare is maximised and a condition of Pareto
optimality is approached.

Predictions of the model

The perfect competition model allows certain predictions
to be made following changes in exogenous factors. These
include:
1. Changes in fixed costs will not alter the price level
or the firm's output level in the SR. In the LR, if fixed
costs increase, the price will rise. The ouput level of
the firm depends on the cost conditions facing the firm.
2. Changes in variable costs will alter the price and
output level in both the SR and the LR. An increase in the
variable costs will increase the price and decrease supply.
The increase in price will be less in the SR than in the LR
3. An increase in demand will increase the output of the
firm and increase price and profits in the SR. In the LR
the price will fall from the new level, the extent of the
fall depending again on the cost conditions facing the
firm.

Summary of Neoclassical theory

The previous sections have demonstrated the fundamentals
of the neoclassical economic theory of the firm. The
perfect competition model is just one example of how the

cost curves derived in the first section combine with the
demand conditions to give prices. Other market forms
include monopoly, imperfect or monopolistic competition and
various forms of oligopoly. Although the predictions as to
price and output differ between each model, the basic
assumptions and analytical tools used are the same.

Neoclassical economic analysis has been extended to cover
such issues as welfare economics (see for example Pigou
(1932), Mishan (1975), Coase (1960), Kaldor (1939), Pearce
(1978), Baumol and Oates (1975), Dasgupta and Pearce (1972)),
including cost benefit analysis and externality treatment.
There have also been developments to the models and empirical
investigations of such issues as economies of scale (see for
example Lancaster (1969), Silberston (1972), Scherer et al
(1970) and Pratten (1971)). The fundamental basis of
neoclassical economics, however, has not really changed. This
section concludes with a summary of the basic neoclassical
approach.

1. Neoclassical economics is concerned with equilibrium
analysis. Firms are assumed to move from one equilibrium
to another with no consideration of the process by which
they do so.
2. The firm is owned by an entrepreneur who has unitary
control over costs.
3. The firm's sole objective is to maximise profits.
4. The entrepreneur is globally rational.
5. Costs are determined mechanically from production

42

functions and factor prices, all of which are known.

6. Output is determined by the equalisation of MC and MR.
Price is determined by consideration of the demand curve at
this point.

7. The long run is a succession of short run periods.
Profit maximisation in the short run leads, therefore, to
long run profit maximisation.

3.3 Transport Literature and Neoclassical Economics

Having considered the basic neoclassical approach to
costing and pricing, the next stage is to consider the
literature on transport costing and pricing and how it
relates to neoclassical economic theory. The importance
attached to such theory in the context of costing and
pricing can be gauged from the extensive use of
neoclassical assumptions in the literature on road freight
transport operating costs. For the purpose of exposition,
the literature can be divided into four categories, each
differing in the degree of explicitness about the
assumptions it makes. The categories are, of course,
simplifications. Not all of the literature falls neatly
into any one particular category. They serve, however, as
a useful framework of classification.

Much of the basic transport text containing analysis of
operating costs and pricing is quite explicit in its
adoption of a neoclassical economic stance. In this

review, literature in this category follows the descriptive economic approach. Literature relating to policy discussion is less open about its theoretical basis and the assumptions associated with it. It is ideological in its ambitions and is therefore labelled the ideological economic approach. The techno-economic approach describes literature which assumes that the technical characteristics of either the product carried or the journey itself determines the cost of transport. Finally, there is the literature which is purely prescriptive in that it sets out the costs which should be taken into account when costing and suggests how costs should be computed. This is labelled the accounting economic approach.

3.3.1 Examples of the approaches to transport costing

1. The descriptive economic approach

Literature in this category is explicitly neoclassical in its approach. It is typically a transport text book with early chapters (Button and Pearman (1981), Button (1932), Stubbs et al (1980), Bell et al (1984),) or sections of a chapter (Hicks (1977), Sharp (1973), Bell et al (1983, Gwilliam and Mackie (1975)) on the neoclassical theory of the firm and goes on to describe freight operating costs in practice. The chapter/section describing costs is frequently not explicitly related to neoclassical economics. Vague attempts at relating economic theory to

practice may be made by relating economic concepts such as
joint costs or marginal costs to transport examples, but it
is mostly left to the interpretation of the reader.
Departures from neoclassical theory are described (e.g.
that no costings are done by many firms), though they are
never stated to be such, and the difficulties of relating
neoclassical economics to empirical observations (such as
the problems caused by discontinuities in the production
function) are identified, but the theoretical implications
of these matters are taken no further. It is as if the
authors are seeking another theory to explain the
departures from traditional theory, but none is available.
Thus, as much as possible is described in neoclassical
terminology but departures from the theory are left
empirically described, but theoretically unexplained.

2. The ideological economic approach

The essence of the ideological economic approach is that
costing/pricing is related to the implicit ideological
ambitions of the authors. Literature falling into this
category is typically, but not invariably, government
policy orientated. The general ideology adopted is that of
neoclassical economics.

The Armitage report (1980) is an obvious example of
literature adopting this approach. It contains no explicit
theoretical assumptions, yet the underlying ideology is
quite apparent. Statements such as "In the case of

lorries, the market will best determine the proper level of demand because through it the economic costs and benefits of lorries will be brought home to those taking direct and indirect decisions about transport", demonstrates Armitage's belief that "it is in the public interest that lorries should pay at least their road track costs since by this means there will be a better allocation of economic resources than there would otherwise have been". This is clearly neoclassical in nature and ideology, though it recognises that complete freedom of the market is inefficient in the presence of externalities.

Legislation has become increasingly neoclassical in outlook since the 1960's. Based on the reports of several influential commissions (Geddes Commission 1963, the Foster Commission 1978 and the Armitage Commission 1980), it has concentrated on the promotion of efficiency through competition, coupled with the internalisation of the adverse social and environmental effects of transport. That is, it has been encouraging marginal social cost pricing - a policy which is clearly neoclassical in nature. Thus between 1933 and 1968, intermodal competition was restricted by protectionist policies designed to aid the railways. It was not until the Geddes Commission that free competition was declared beneficial on efficiency grounds.

The external effects of transport had long been known, but it was only in the 1977 White Paper on transport (Cmnd 6836) that the Labour Government started to deal with the

problems specifically. It stated " the government is moving towards making sure that the taxation on lorries covers their share of the public costs of roads including the cost of policing them and of accidents".

In 1981, a transport White Paper (Cmnd 8439), produced under a Conservative Government, strove closer to recommending marginal social cost pricing by stating that "fair competition means in particular that each category of heavy lorry should pay in motoring taxation at least the full cost attributed to it".

Neoclassical ideology is not confined to government policy documents. Rowley et al (1983), in comparing the cost of transporting goods by road with transporting them by roll-on roll-off ferry, are concerned with their respective marginal costs. They also state "if, as has been suggested above, returns to scale with respect to fleet size are constant in road haulage, LRMC = LRAC and represents the level towards which road haulage charges will tend to converge if competition is preserved". This is again clearly neoclassical.

3. The techno-economic approach

The objective of the literature on the techno-economic approach is cost minimisation based on consideration of the technical attributes of the product carried (e.g. weight,

47

volume), or the trip made (e.g. length, frequency). It is essentially the same as the "technological positivist category as defined by Gray (1982) in relation to modal choice decisions.

An example of the literature in this category is the OECD (1983) who say that the costs of operating heavy freight vehicles depends on "a range of parameters which may or may not be linked and which pertain to both operating conditions and vehicle characteristics". The factors they include are;

1. productivity indicators; annual distance travelled, weight load factors.

2. vehicle configuration; vehicle type, axle load and number of axles.

3. conditions of use; nature and size of carrier, commodities transported and road alignment and conditions.

Thus costs are linked purely to technical attributes. In a similar vein, Roberts (1971) adopts a logistics approach to transport. He uses a "model to manage the logistics of a single item inventory point operating as a decentralised profit centre,"......"with the objective of minimising costs associated with the logistics function (order cost, transport cost, storage cost, capital carrying cost and stock out costs. The model is constructed from six generalised variables:

1) the level of demand,

48

2) length and characteristics of haul,

3) characteristics of the commodity,

4) the quantity to be ordered

5) the reorder point

6) the choice of mode

A minimum logistics cost per unit is found from the addition of the above criteria.

Literature which includes the extrapolation of costs based on purportedly objective published tables of operating costs also come within this category. Wood (1983), for instance, when calculating the costs of the lorry bans in London, extrapolates from a cost based on an estimated number of tonne-kilometers before and after the proposed bans. All costs were taken directly from Motor Transport tables of operating costs. Like the models above, the extrapolations based on supposedly technical data assume that all firms have the same costs and that they will all react in the same way to changes in conditions. Other literature to do this includes the Armitage report (1980), Patterson and May (1982), Hall (1982), Rowley et al (1983) and Mackie and Harding (1982).

4. The Accounting-Economic approach

The literature in this category is the easiest to classify. It consists of prescriptive expositions of what cost frameworks should comprise and how they should be

calculated. There are no explicit underlying theoretical assumptions, but again, by advising how costs should be calculated and by expounding the virtues of costing, they are implicitly assuming that cost minimisation is of paramount importance. Literature in this category includes Lowe (1983), Cooke (1974), Bassett (1974), Stewart-David (1980), Lee (1969), Ratcliffe(1982) and Faulks (1977).

It has been shown above that much of the work on transport economics is either implicitly or explicitly neoclassical in its assumptions. There is however, a growing body of evidence of an empirical nature relating directly to road freight transport which is contradictory to such theory. It is to this that we now turn.

3.4. Evidence from the freight transport industry against the neoclassical theory of the firm.

One of the principal observations against neoclassical economics is that transport providers are not seeking to minimise costs. Hicks (1977) for instance says "There are a number of indicators that transport costs, though never consciously and unnecessarily increased, are not presently being minimised". He suggests three reasons for this:

1. Some firms undertaking trucking tasks may lack transport and distribution management skills. Some managers rely on 'seat of the pants' instinctive

management.

2. Transport users and operators may lack the access to planning and coordination which would enable them to take advantage of economies.

3. Demand for freight transport may be quite inelastic to changes in costs.

Evidence that firms were not seeking to minimise costs is also given by Edwards(1971) in a major study of the road haulage business. According to Edwards, one reason why cost minimisation does not take place is that smaller hauliers were forced to buy vehicles that were suitable for most jobs but ideal for none.

Local authority use of vehicles has recently come under a great deal of scrutiny because of alleged inefficiencies in their use. Slater (1985) states "Public sector transport is full of inefficiency. Revenue is low, use is low and the workshops are too big.... Public sector organisations tended to buy enough vehicles to meet peak demand which resulted in low use. Low use and high maintenance cost resulted in high operating costs. It is also true that maintenance standards are rigid, often reflecting the oldest vehicle in the fleet".

The proposition that cost minimisation is not of primary importance is demonstrated by operators' lack of knowledge of their operating costs. A study of 29 firms in the Black country by Cook (1967) found that "some transport

departments had very little cost information available and saw their work as organising the moving of certain physical tonnages, making up loads and keeping customers satisfied". When operators were asked about their outward costs, Cook says "perhaps the most significant fact.... was the lack of precision in the answers. It was clear that transport managers were not very much aware of the importance of transport in the costs of the various products they were moving. Where they had an idea of transport cost, it was the general average which masked wide variations".

A similar study by Sharp (1967) of the West Midlands found that 49% of the operators surveyed only had a general idea of the cost of their operations, while 19% had no idea at all. The Price Commission (1977) found that "among small operators knowledge and grasp of costs was often found to be rudimentary, ranging down to almost subjective rule-of-thumb judgements derived from experience". However, they found that the situation was different for larger operators "who took greater care to analyse their costs and to make sure they included all economic costs, including capital costs".

In the USA, Wyckoff and Maister (1975) quote a study by Owner Operator magazine which found that "relatively few operators know their actual expenses and frequently depended on rules-of-thumb that might well be subject to doubt as to timeliness or appropriateness to the operators specific operation".

In a more recent study, Patterson and May (1981) found
that 71% of managers of firms in their survey were able to
specify their transport costs as a proportion of total
non capital goods. When they delved further, however, they
discovered that "there was a general inability of
management to cost their transport problems".

Westwood (1985) found that 70 % of the firms he surveyed
could not produce adequate distribution statistics and
costs, although they knew their production costs very
accurately. Finally Semple (1985) says that hauliers are
their own worst enemies because "A lot of small hauliers
count diesel, tyres, and the drivers wages and think that
is the total cost".

Button (1982) states that hauliers misperceive costs in
four ways:

1. Money or time cost may be so small that it is not
worth taking into account.
2. Certain variable costs may be regarded as fixed
costs.
3. Users may be unaware of the connection between a
particular action and the costs to which it gives rise.
4. Habit can make regular trip-makers unaware of
changing cost conditions over time even if they were
fully cognizant of the full resource cost of their
actions at some earlier point in time.

Achievement of budgets or targets was found by several
authors to be more important than absolute cost
minimisation (Cook (1967), Ratcliffe (1982), Stewart-Davis
(1980), Price Commission (1977).

Thus, not only do operators have little knowledge of their
costs, but also the situation does not appear to be
changing greatly over time.

Operators often state that service to customers is their
principal objective rather than minimisation of costs.
Cook (1967) found that amongst the operators in his survey
"there was a tendency to talk about transport primarily in
terms of service to the customer and only secondly, if at
all, in terms of cost". Similarly the Foster Commision
(1978) found that "to own account operators, sometimes
quality considerations will be so important that the own
account operator will tolerate relatively low productivity
in his transport fleet in order to keep the operation under
close control". Westwood (1985) also stated "I've looked
into why companies choose to run their own transport and
financial reasons are not the most important. Instead,
most think they get a better service from their own
transport".

Given that service is the dominant reason for modal choice
(see for example Pike 1982, Price Commission 1977, Bayliss
1973), provision of a good service is a necessity and could

be viewed as an effort towards profit maximisation.

However, profit maximisation implies that any service that

is provided should be performed at minimum cost and weighed

up against the marginal revenue from providing that

service. It is clear from the above that this is not the

case. Hill (1982) in a case study of a large national food

distribution company found that "profits were being made

from only 31% of its customers, the other 69% were being

supplied at a loss". The reason for this, Hill found, was

that costs were only being looked at in total and not on a

per customer basis. When the latter was done, he

discovered that some customers were demanding too good a

distribution service. Hill calculated that by considering

customer profitability in this way, British companies could

save £2000m or more.

A similar study by Cox (1981) of a company with a depot in

Leeds servicing 2790 accounts with 29 vehicles found that

in 28% of the accounts, the direct costs exceeded the gross

margin on the business transacted, 38% were contributing to

fixed costs and profit but not adequately so, while 34%

were profitable in every case. Again, the reason given for

this poor record was the service demands of customers.

Neoclassical theory suggests that through the principal of

marginal substitution, firms always use the most up to date

and efficient method of operating. It is clear, however,

that profit maximisation is hindered to a considerable

extent by habit. Hoppe (1981) for instance, states that "high costs may result from bad route location decisions of 50 years ago".

The same can be said of the use of new technology or techniques. Since the 1968 Transport Act, own account (O/A) operators have been legally able to carry goods for others. Yet Cooper and Doganis (1978) in their study of the advantages taken of this change found that "only 11% of firms involved in manufacturing even considered the idea of carrying for others". The proportion of total tonnage carried by O/A operators was only 2.7%. While it is recognised that many firms are unable to accept backloads because, for instance, of the specialised nature of their vehicles, 2.7% is extremely low and probably reflects the lack of determination to maximise profits.

In another study by Cooper and Doganis (1982) of the potential use of demountables in distribution, they state that one of the reasons why demountables were not used to any great extent was the "conservative attitudes" of operators mixed with institutional problems. Similar reasoning could be applied to operators' speedy acceptance of the 38 tonne vehicle. In the past, heavier lorries have been accompanied by considerable economies of scale. It was naturally assumed that this would be the case with the 38 tonner. The prospective advantages were therefore accepted without a great deal of critical analysis.

Neoclassical economics also suggests that all possible alternative courses of action and their associated outcomes are known. Yet part of the reason why the principal of marginal substitution is not put into practice is the lack of information, or at least, the impossibility of assimilating the information. Consider the relatively simple matter of vehicle replacement. Consultants (e.g. Wilcox 1985) advocate the use of a 'whole life' replacement policy - which basically entails taking into consideration the likely maintenance and performance of the vehicle as well as the purchase price when purchasing a vehicle. But as Brock (1985) says " But is the operator fully able to assess just what his whole life costs will be? ..... For some of the facts he will have to rely on his own professionalism, using his own judgement of the drivers he employs and the vehicles he buys". Accurate knowledge of these facts is impossible.

Lack of information is not the only reason for inefficiencies in vehicle replacement. It was found in a recent study (Motor Transport 1986) that only 40% of operators have a specific vehicle replacement policy. The remainder use intuition. These two reasons go some way to explain why Sussams (1983) estimated that in 1982 up to £100m could be saved by scrapping goods vehicles which should, theoretically, no longer be on the road and replacing them with new more cost effective vehicles.

Since firms do not know their marginal costs it is
impossible for them to engage in marginal cost pricing. In
fact, many methods of pricing are used. The FTA (1983),
for instance, state that all too often "the method of rate
setting consists merely of finding out what is currently
being paid and undercutting it". Walters (1968) suggested
that one of the reasons for the wide variations in rates,
was that hauliers had little knowledge of how to calculate
them. The joint Price Commission/Foster Commission survey
found that the basis on which haulage charges were set
depended to some degree on the size of the fleet. Their
findings are shown in table 3.1

TABLE 3.1

BASIS ON WHICH PROFESSIONAL HAULIERS' PRICES ARE SET
BY SIZE OF FLEET.

Percentages

Fleet size	2 - 5	6 - 20	21 - 100	101 +
Own cost	58.0	70.6	76.0	69.0
Competitors charges	24.0	12.5	10.0	15.0
Level of demand	8.5	8.7	7.8	8.0
Service requirements	9.5	8.2	6.2	8.0

Source: Joint Price Commission/ Foster Commission 1977

The same survey further found that methods of pricing
based on own rates included; cost or cost plus, periodic
negotiated rates, published scales and contracts exclusive
to a specific customer.

Bell (1984) found that "transport operators sometimes make decisions that surprise and concern us" and he cites the following empirical observations which are clearly incompatible with neoclassical economics:

1. Some people buy a vehicle and set up business on the most vague promise of work.

2. Some operators have little idea of which of their vehicles or services are making money and which are not.

3. Some businesses consistently underprice their operations and soon find that they cannot cover their overheads.

4. Many vehicles or items of machinery are purchased without much thought to their real cost and the benefits they will bring.

Thus, despite the dependence of the transport literature on neoclassical economic theory, it is quite clear from the empirical evidence that firms in the road freight transport industry do not behave according to neoclassical theory, nor are the outcomes those suggested by such theory.

3.5. The Neoclassical Defence and Arguments Against It.

The empirical observations referred to above would not be accepted by some neoclassicists as a refutation of the validity of the theory. Lipsey (1978), for instance, says that the criticism that businessmen do not equate MC and MR is crude "because the constructs of the theory of the firm

are purely logical tools and are not meant to be a description of how businessmen reach decisions". He continues "the observation that businessmen do not calculate down to single units is not of itself relevant as a test of the theory. If he is maximising his profits he will be observed to respond in this way even though he calculates in a much cruder fashion than does the mathematician". Thus, he believes that the theory is being used in the wrong manner.

Machlup (1967), probably the staunchest supporter of marginalism, says essentially the same thing. It is worth quoting him at length since his views so aptly summarise the neoclassical defence. He states: "to confuse the firm as theoretical construct with the firm as an empirical concept, that is to confuse a heuristic fiction with a real organisation like General Motors or Atlantic and Pacific is to commit the fallacy of misplaced concreteness. This fallacy consists in using theoretical symbols as though they had a direct observable concrete meaning...... as far as the problems of competitive price theory, any likeness between the theoretical concept of the firm and the empirical firm is purely coincidental"........

...... "the question is not whether the firms of the real world will really maximise money profits or whether they even strive to maximise their money profits, but rather whether the assumption that this is the objective of the theoretical firms in the artificial world of our

construction will lead to conclusions - inferred outcomes - very different from those derived from admittedly more realistic assumptions".

Machlup believes that the theory is concerned with the derived predictions rather than the processes by which the outcomes are reached. He recognises that firms do not have all the information required to make rational decisions but says "marginal analysis of the firm should not be understood to imply anything but subjective estimates, guesses and hunches". Thus he is advocating subjective maximisation. This is supported by Friedman (1953) who says that "individual firms behave as if they were seeking rationally to maximise their expected returns and had full knowledge of the data needed to succeed in the attempt". Thus, the neoclassical defenders accept that the assumptions of neoclassical economics are extreme but posit that behaviour approaches maximisation despite this.

Even the central proposition of neoclassical theory i.e. profit maximisation, has been subjected to this type of theoretical manipulation. Stigler (1952) states that "no economist would deny that all entrepreneurs are subject to other desires that may conflict with profit maximisation, nor even that some of these other forces may be widespread and important. Rather the position is that profit maximisation is the strongest, the most universal and the most persistent of the forces governing entrepreneurial behaviour".

Thus the two major arguments in defence of marginalism are
that the theory has been wrongly used and that firms
subjectively maximise profits even if they cannot
objectively maximise them.

Considering the first point, the prediction of prices and
output poses tremendous problems, given the economic
concepts involved in the theory. Prediction of price and
output require a knowledge of both supply and demand
conditions facing the firm. Estimation of the firm's cost
curves are difficult enough. As Hay and Morris (1981) state
"the first (problem) is that the concept of 'normal costs'
incorporated in the longer run average cost curve cannot be
deduced directly from the actual cost data of firms. The
difficulties concern the imputations of rents to
specialised, more efficient factors, and the problem of
distinguishing normal profit from other surpluses". Nor is
the problem confined to specialised more efficient factors.
The price paid for any resources will rarely be equal to
the opportunity cost of those resources. This is
especially so when resources were purchased in the past and
the price no longer gives any indication of their present
value. Furthermore, as Johnson (1960) says, a firm may
make use of specific factors to which no imputed value can
be attached; an example of this being good industrial
relations. Thus the problem of imputation makes prediction
very difficult.

Imputation of costs is a static problem. When dynamics are involved, even at the level of "what will happen if demand for the product changes", the problems are greatly magnified. The economist must then know the cost conditions facing the firm. These in turn depend on so many factors, that estimation of price and output becomes impossible.

Additionally, it is always supposed that the structure of the industry is known i.e. that the economist knows whether the firm is in, say, a perfectly competitive or monopolistically competitive market. In reality, markets are not so well defined; any one industry displays attributes taken from several market structures.

When demand is introduced, the prediction situation becomes hopeless. The demand curve facing the perfectly competitive firm is known, in that the firm is a price taker. In a monopolistically competitive market, or any other market form, this is not the case. Without a knowledge of the demand curve, predictions of price and output cannot be made. Yet, as Robinson (1963) says "in reality, evidently, an individual demand curve (for a particular product produced by a particular firm) is a mere smudge to which it is vain to attribute elegant geometrical properties".

The notion that prices and output can be predicted, therefore, is exremely debatable. As Baumol and Stewart (1971) say "maximising models are rarely in a position to provide quantitative predictions about the behaviour of individual firms". Prediction of the direction of change following changes in the demand and supply conditions is the best that can be hoped for.

The neoclassical theory is so internally consistent, however, that the predictions can rarely be refuted. If the outcome is not that expected by the theory then it may be that the firm is in disequilibrium, making the prediction inapplicable, or that costs have been badly or incorrectly measured.

Robinson's analysis of the firm is seen as an integral part of neoclassical theory, yet she herself later (1963) states that her book was written "to analyse the slogans of the 30s' and that "the assumptions which were adequate for dealing with such questions are by no means a suitable basis for an analysis of the problems of prices, production and distribution which present themselves in reality".

The neoclassical theory of the firm is not, therefore, capable of accurate predictions.

If the second neoclassical defence is accepted (i.e. that firms subjectively maximise), then the whole theory becomes

a tautology. An apparently ridiculous stage is then reached whereby any action that a firm takes is deemed to be maximising. Asked what the minimum cost is and what firm achieves it, the response given by Friedman is "surely the obvious answer is; the firms of existing size". i.e. any firm in existence must be minimising costs. This is singularly unhelpful.

To demonstrate the nature of the theory, consider a concrete example. The introduction of the 38 tonne vehicle was heralded as a great step forward by operators because of the purported cost advantages. To begin with, use of the heavier vehicles was very profitable because only a few operators had them. Six months later, customers started saying "what about a share of the savings?" (Russett 1984). Rates fell. Operators are now saying "unfortunately the weight increase has ended up depressing rates now that everyone is working at the new maximum".(Commercial Motor 1985)

This scenario seems to correspond to the neoclassical prediction. However, many operators complain that rates are too low. Janus, features writer in CM, says that "Operators were always complaining ""How can I make a profit? My customers won't pay anything like what it costs me to operate"". And as he resorts to increasingly desperate rate cutting to stave off the evil day, he causes problems for other hauliers". The problem is that there is no way of determining the correct price (i.e. the price

predicted by neoclassical economics). Thus although the theory superficially predicts the correct outcome, it could well be that firms are settling for a rate that is far below their marginal costs. This would explain the very high bankruptcy rate amongst hauliers, which, at 11% of all bankruptcies, is second only to construction companies. (MT 1986)

Referring back to the empirical evidence on freight transport operations (section 3.4), the inapplicability of neoclassical economics to this area is still very much apparent. The use of budgets could possibly be construed to be commensurate with profit maximisation. However it takes a great deal of imagination to tie in with this objective, the fact that many firms have no idea of their costs and use published cost tables to calculate rates, amongst other things. As Hay and Morris (1981) say "If the profit maximising assumption abstracts from other motives that businessmen have, this may be quite acceptable. If businessmen do not in fact want or try to earn maximum profits, then theories based on profit maximisation may be questionned irrespective of their predictive power". To do no costings and to use published cost tables for setting rates strongly suggests that the maximisation of profits is not a major goal.

Many authors of freight transport literature acknowledge that the facts of the industry do not fit the neoclassical theory, yet they are forced to present them in a

neoclassical framework because they have considered no alternative theories. Literature in the economic-descriptive approach category is left high and dry with empirical results bearing no relation to the author's chosen theory, whilst literature in the techno-economic approach is forced to make erroneous predictions based on the same theory. Again, it is as if they are searching desperately for an alternative theory to explain the deviations from 'traditional' theory, but their feelers fall on empty ground. Alternatively, they are loathe to leave the sanctuary of the established theory.

There is, then, clearly a need for a more applicable theory. It is suggested here that the observed deviations from neoclassical theory are partly supportive of the behavioural theory of economics as propounded by the Carnegie School. It is to this theory that we now turn.

CHAPTER 4

BEHAVIOURAL THEORY OF THE FIRM

4.1   Introduction

The preceding chapter showed how despite the
inapplicability of neoclassical economics to road freight
transport costing and pricing, it was frequently used by
academics and legislators because of a perceived lack of
alternative theories. It was suggested at the end of the
chapter that the behavioural theory of the firm may provide
such an alternative. This chapter considers behavioural
theory in some detail. It starts with an overview of the
literature on the subject to demonstrate what the theory
involves. To illustrate the value and potential of the
theory's contribution, it then goes on to show how it has
been applied to other areas of study. It is suggested
that the theory could provide a valuable explanation of the
behaviour of road freight decision makers. The chapter
concludes by proposing a theoretical conceptual model based
on the theory.

4.2   Overview of the literature

4.2.1 The Carnegie School Approach

a) Simon

A major attack on the prevailing orthodoxy of neoclassical economics was launched in the 1950s and 1960s by the organisational theorists of the Carnegie School (notably H.A Simon, J.G March, R.M Cyert and K.J Cohen). Behavioural organisational theory, or as Pfeffer (1982) calls it 'decision process theory,' was a reaction against the assumptions and approach of neoclassical economics, where the actions and objectives of individual members of the organisation were subsumed under those of the firm, which was treated as a 'black box', and where the sole rationale for decision making was profit maximisation, or as Mazzolini (1981) put it "where the company is a monolithic agent and it is this agent which is the decider and actor". The theme of Simon's seminal works was decision making; not what decisions are made, but how decisions are arrived at in highly complex organisations composed of individual members with a wide diversity of goals. His aim was "to propose a theory of human choice or decision making that aims to be sufficiently broad and realistic to accommodate both those rational aspects of choice that have been the principal concern of the economist and those properties and limitations of the human decision making mechanism that have attracted the attention of psychologists and practical decision makers". (Simon 1957)

The Carnegie School was not the first to revolt against the neoclassical paradigm; various individual studies, especially those of an empirical nature, had previously called the whole area into question. The most famous of these was that by Hall and Hitch (1951) which purported to show that prices were not set according to the marginal cost principle but by using the full cost or mark up method. This was supported by Cooper (1951). Gordon (1948) showed how actions of firms were governed by standard business procedures and shortcuts, whilst Katona (1951), one of the first to apply psychology to the study of economic behaviour, wrote about the setting and dynamism of aspiration levels.

The theories of the Carnegie School, however, found such a wide audience because as Loasby (1976) says "it not only illuminates the affinities between economics and organisational theory; it is a natural extension of the subject being characteristically concerned with the relationship between structure and performance and the ways in which the system responds to and regulates choice". Although the behavioural theory has not been universally accepted (see for instance Baumol (1972), Machlup (1967), Baumol and Stewart (1971)) it nevertheless has much to offer decision making theory.

Simon's principal concern was the inapplicability of the assumptions underlying neoclassical economics, especially

70

that of global rationality. Classical economics, he said, was concerned with 'rational man' who is "assumed to have a well organised and stable system of preferences and skill in computation that enables him to calculate for the alternative courses of action that are available to him, which of these will permit him to reach the highest attainable point on his preference scale". His task was "to replace the global rationality of economic man with a kind of rational behaviour that is compatible with the access to information and the computational capacities that are actually possessed by organisms, including man, in the kinds of environments in which such organisms exist". (Simon 1955). Thus individuals were 'intendedly' rational i.e. behaviour was task oriented, but 'limitedly' so. Following directly from this is the proposal that "rational man is a satisfying rather than an optimal animal" and he is the former rather than the latter because he "does not have the wits to be the latter".(Simon 1957).

The individual decision maker is thus constrained in his decision making behaviour, or what is the same to Simon, his managerial ability, by his intellectual capacity. Unlike the classical rational man, an individual does not "stand on a mountain top viewing the whole world at his feet and make a global omniscient rational choice. He is rational within the bounds set by his social role of economic man". Although the production manager will be unable to maximise profits because of imperfect knowledge of the production function, the intendedly rational man

71

by making a series of approximations, each of which has the same reasonable justification, rephrase the optimisation problem so as to bring it within the capacities of humans for making estimates and forming expectations". (Simon 1958).

The concept of bounded rationality, then, is the crux of behavioural decision making theory; the central proposition from which the remainder of the theory emanates.

Thus the difference between neoclassical economic theory and the behavioural theory propounded by Simon, is, as Loasby (1976) says "the economic theorist studies the rules of the game. The organisational theorist begins by designing the game."

Simon was specifically concerned with applying the concept of bounded rationality to the economic 'givens', in neoclassical theory in order to demonstrate the consequences for theory as well as for the prediction and explanation of economic behaviour. In particular he dealt with three principal economic givens:

1. the set of alternatives open to choice

2. the relationships that determine the payoffs (satisfactions, goal attainment) as a function of the alternative that is chosen and

3. the preference orderings among payoffs.

(Simon 1955)

He argued that because of the "psychological limits of the organism" individuals would have to construct simplified models of the situation facing him in order to be able to make decisions. Simple rules of thumb in particular would be used.

Simon saw decision making as consisting of 3 phases:

1. finding occasions for making decisions, which he called intelligence;

2. finding possible courses of action, which he called design and

3. choosing among different courses of action, called choice.

The decision making process would also differ according to whether the decision was 'programmed' or 'non programmed'. Programmed decisions are those which are "repetitive and routine to the extent that a definite procedure has been worked out for handling them so that they don't have to be treated 'de novo' each time". Non programmed decisions are those which are "novel unstructured and consequential". (1960). The two types of decision require different techniques. Programmed decisions are solved first and foremost by habit and secondly by 'standard operating procedures' (SOPs) that have been developed within the firm. The difference between habit and standard operating procedures is that the former is internalised whilst the

latter are often formal written, recorded programmes.
Together they act as a stimulus-response type mechanism for
dealing with information.

Unprogrammed decision making requires judgement, insight
and creativity and can be aided by training. When making
decisions of either nature, the decision maker does not
consider all alternatives in order to optimise the outcome,
but rather alternatives are considered sequentially and the
first satisfactory outcome that is evaluated is selected;
the decision maker satisfices rather than maximises.
Evaluating all the alternatives would be pointless even
supposing they were all known because the organism does not
"have a set of weights for comparing the components of a
multiple payoff". (Simon 1955).

b) March and Simon

Aspiration levels play a very important part in Simon's
theory as they define what is satisfactory. Aspiration
levels are not stable throughout the choice phase, but
adjust so that a satisfactory solution is always
attainable, "for the failure to discover a solution would
depress the aspiration level and bring satisfactory
solutions into existence". (Simon 1955).

March and Simon (1958) proposed a model of motivation
as follows:-

1. the lower the satisfaction of the organism the more

search for alternative programmes it will undertake;

2. the more the search, the higher the expected value of reward;

3. the higher the expected value of reward, the higher the satisfaction;

4. the higher the expected value of reward, the higher the level of aspiration of the organism;

5. the higher the level of aspiration, the lower the satisfaction.

Thus there is a dynamic process of aspiration level change which is directly related to previous attainment levels. Search for alternatives is similarly related to previous attainment levels and aspirations.

The alternatives the individual considers and the consequences he anticipates depend on the organisational and social environment he finds himself in.

The theory of rational choice propounded by March and Simon incorporates two fundamental characteristics:-

1. choice is always exercised with respect to a limited, approximate simplified 'model of the real situation' i.e. an individual's definition of the situation;

2. the elements of the definition of the situation are the outcome of psychological and sociological processes including the chooser's own activities and the activities of others in his environment.

Thus without a frame of reference choice cannot be made. The theory proposed by March and Simon is much the same as Simon's earlier theory; satisficing is proposed as possible; standard operating procedures (SOPs) help to control the organisation and provide an important coordination mechanism. They also consider the aspect of divisionalising organisations into subunits to permit specialisation, which they see as rational in their terms, but which they postulate causes bias in decision making because attention in each unit is focussed upon only one aspect of the organisation. The existence of subunits also implies the presence of differing operational goals which introduces the need for bargaining before action can take place.

March and Simon describe a problem solving process involving five general characteristics:-

1. the problem is tackled by breaking it down into simple constituents and it is aggregated at the end.

2. much of the process involves search;

3. much of the process involves screening;

4. elementary components of the process are characterised by randomness;

5. the programmes generally have a hierarchical structure.

Much of the organisational member's task is concerned with the daily routine of programmed decision making. It can be

viewed as a short run theory. March and Simon believe that "usually daily routine drives out planning". Unprogrammed decisions are only attended to if they affect goal clarity or deadlines. In these cases, organisational activity will increase. When non programmed decisions are being considered, selective information filtering takes place "at the boundary of the organisation and at every stage in the transmission and elaboration of programme proposals". If the problem is broad, the solution will take time and it will be affected by the diversity of the people among whom it is circulated.

Throughout Simon's analysis there is a continuous interplay between the individual and the firm (or organisation). The mechanisms of the firm shape the behaviour of the individual so that the behaviour conforms more or less to the goals of the firm. The organisation "specifies the individual's function, allocates authority and sets other limits to choice ....and takes from the individual some of his decisional autonomy and substitutes it for an organisational decision making process". (Simon 1957). In fact, one function of the firm is "to place the organisational members in a psychological environment that will adapt their decisions to the organisational objectives and will provide them with the information needed to make these decisions correctly". The individual is thus engulfed by the firm and is basically assumed to be a

characterless, intendedly rational being - or organism as
Simon refers to him.

  c) Cyert and March

The most comprehensive exposition of the Carnegie School
theory appears in the now famous book "A Behavioural Theory
of the Firm" by Cyert and March (1963). It is in this book
that a model, which pieces together all the individual
elements previously considered, is developed. The
objectives of the model are "to focus on a key number of
economic decisions to develop a process oriented model of
the firm which would fit empirical observations as far as
possible". The firm is seen as "a coalition of
participants with disparate demands, changing foci of
attention and limited ability to attend to all
organisational problems simultaneously".

Individuals have differing objectives from each other and
perhaps differing objectives from those of the firm as a
whole. The firm has a set of goals which are viewed as
being independent constraints which are imposed on the
organisation "through a process of bargaining among
potential coalition members".

It is primarily the 'active group' who set the targets for
the goals. Certain of the goals will be stated as
'normative dictums' (Cohen and Cyert 1975), e.g. profit
margins must be at least 5%. These targets are imposed by

control systems such as budgets which Cyert and March see as having two important roles: 1. as a management control device to implement policies on which the firm has decided and to check achievement against established criteria 2. a device to determine feasible programs. Thus it defines in advance a set of fixed commitments.

The target levels are dependent on the aspiration levels of the active group, past achievement levels and the environment.

The continuous goal conflict between the coalition members is partially resolved through the existence of organisational slack i.e. the difference between total resources available to the organisation and total payments required to maintain the coalition. Slack depends on the aspirations of the organisational members and on their perceptions of the alternatives open to them. Since aspiration levels lag behind achievement levels, in an economic upturn slack increases and for the opposite reasons, decreases in the bad times. If the bad times persist, slack may be totally eliminated because aspiration levels will coincide with actual performance levels.

Slack is a difficult concept. It is defined as payments that are made over and above those required to maintain the coalition. Thus, as Cyert and March say "activities that represent slack at any one time may represent necessary costs at another". For example, suppose at the start of a

boom period, a firm decides to buy their drivers vehicles with luxurious cabs. At this stage luxurious cabs may represent a slack payment because it is unnecessary for the maintenance of the coalition and arises because although the resources available to the firm have increased, aspiration levels have not adjusted to meet this fact. However, as aspiration levels rise, the same drivers recognise that it is now the norm for drivers to receive such cabs. The latter thus changes from, being a slack payment to a required payment. However, at some stage, unless the boom continues indefinitely, the cabs will again become slack. This happens as a downturn comes along and the drivers aspiration levels decrease. However because of the nature of search, the company would not consider getting rid of them unless it was in financial trouble.

Thus the existence of what we may loosely term 'luxuries' does not necessarily infer the existence of slack. Slack is immeasurable without a knowledge of the aspiration levels and expectations of individuals. Furthermore, the ability to greatly reduce costs (Cyert and March use the example of Ford cutting costs by £20m a year faced with a failure), does not necessarily imply that the original high level of costs was due to the existence of slack. At one stage they may have represented necessary payments. However, the fact that costs were cut so dramatically also implies that at some stage the level of necessary payments fell without a fall in actual payments; thus slack came into existence.

Because of market imperfections, aspiration levels and
problem oriented search, slack will almlost always exist,
although its level will be continuously changing. The
corollary of this is that slack will increase during the
upturn and probably be at its highest level a short period
after the downturn as illustrated in fig 4.1

FIGURE 4.1

THE RELATIONSHIP BETWEEN SLACK AND TOTAL RESOURCES

OVER TIME
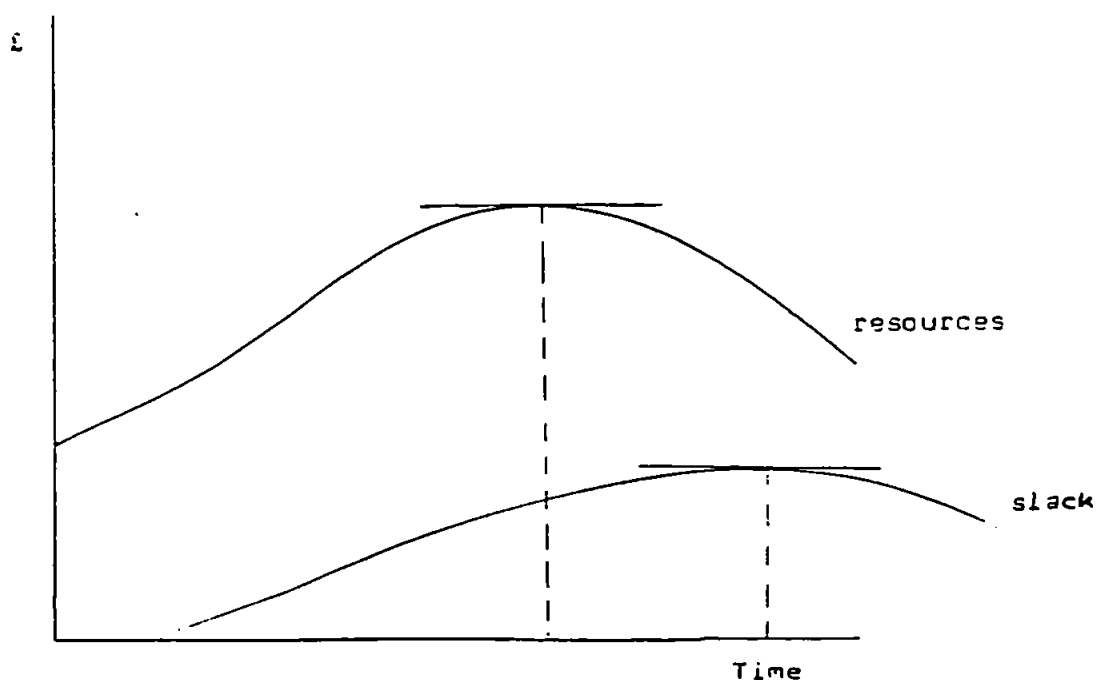
Many of the coalition members receive slack (even the
shareholders), but those higher in the hierarchy are likely
to receive a disproportionate share because of differential
access.

Although slack denotes inefficiency, Cyert and March
propose that it has a stabilising effect in two ways:

1. by absorbing excess resources, it retards upward
adjustment of aspirations during relatively good times

2. by providing a pool of emergency resources, it
permits aspirations to be maintained during relatively
bad periods.

Conflict which arises within firms due to the difference
in members' goals is partially resolved through
organisational slack allocation (in the form of policy
side payments, personal treatments and perquisites as well
as pecuniary benefits). Other methods of conflict
resolution include the sequential attention to goals and
the decentralisation of decision making. These methods do
not eliminate the conflict - that always remains - but they
allow the firm to reach decisions with inconsistent goals.

Decisions are made through solving a series of problems.
Cyert and March say that choice can be summarised in terms of
three basic principles:

1. avoidance of uncertainty. This is achieved through
short run feedback and use of standardised decision rules.

2. maintenance of the rules. Decision rules are only
abandonned under duress.

3. use of simple rules aided by judgement.

This is in marked contrast to the neoclassical principles

of considering all the consequences of all possible alternatives and choosing the one that maximises returns.

Cyert and March also stress the proposition that firms are adaptive organisms; they are adaptive in their goals, attention to rules and their search rules. This leads to a tendency towards conservatism and incrementalism in the firms activities.

4.2.2 Subsequent Developments

Most of the developments since Cyert and March have not been of a substantive nature. Rather there has been a tendency towards incremental change, changes of emphasis and elaboration of particular points.

Lindblom (1959) (writing before the publication of Cyert and March's major work) was also concerned with the difference between neoclassical economic assumptions and practice in the decision making area. He, like Simon, believed that neoclassical economics "assumes intellectual capacities and sources of information that men simply do not possess". He calls his approach to decision making the 'branch' method as compared to the 'root' method advocated by neoclassicists. Lindblom suggests that decision making takes the form of "successive limited comparisons" where the decision maker is "continually building out from the current situation step by step and by smaller and smaller

degrees", rather like the adaptive organism in Cyert and
March's work. Contrary to the Carnegie School, however,
Lindblom suggests that action may precede the formation of
goals because of the difficulty in combining the values of
the various members of the organism, or that goal
formulation may be simultaneous with action, i.e. "one
simultaneously chooses a policy to attain certain
objectives and chooses the objectives themselves."
Lindblom suggests that means-ends analysis is possible only
to the extent that "values are agreed upon are reconcilable
and are stable at the margin."

Like Simon, Lindblom believes that the only method of
solving complex problems is to find ways of drastically
simplifying it. Simplification in Lindblom's analysis is
achieved in two ways: the first is to limit policy
comparisons to those policies that differ in relatively
small degree to those policies already in effect, and the
second is to ignore important possible consequences of
possible policies as well as the values attached to the
neglected consequences. He also argues that the policy of
successive limited comparison is efficient because it makes
the most of the given information. Exclusions from
analysis are made deliberately, systematically, and are
defensible, unlike those in the root method.

Anderson (1983) observing transcripts of the Cuban Missile
Crisis supports Lindblom in the belief that goals are not
formulated in advance but are determined simultaneously

with action. He suggests that the act of decision making and deliberation leads to the discovery of goals. He views the decision making process in this particular case as a series of problem solving activities that have three notable characteristics:

1. sequential choice over an array of non competing causes of action,

2. the act of decision making led to discovery of goals,

3. decision makers were more concerned with avoiding failures than with achieving successes

This latter point concerning the importance attached to the avoidance of failure is supported by Kahneman and Tversky (1982) who argue that the threat of a loss has far greater impact than the possibility of an equivalent gain and that the regret associated with an actual loss tends to be more intense than the regret associated with a missed opportunity. This tends to reinforce Cyert and March's point about the tendency towards incrementalism and adaptation. Incrementalism is also given prominence in Allison's (1971) explanation of the administative process involved during the Cuban Missile Crisis. Allison states "At any given time a government consists of existing organisations each with a fixed set of SOPs and programs. The behaviour of these organisations relevant to an issue in any particular instance is therefore determined primarily by routines established in these organisations prior to that existence, Explanations of a government action starts from this base line, noting incremental

deviations." Although this refers to a government, it need not be organisation specific.

Simon's concept of bounded rationality was viewed by Lindblom as being efficient because it reduced the number of alternatives to be considered so each could be considered in more detail. The advocacy of the efficiency of 'irrationality' in the neoclassical sense has also been paid much attention to by Brunsson (1982). Brunsson distinguishes between 'decision rationality' and 'action rationality'. Decisions need to be translated into actions for an organisation to work. It is Brunsson's proposition that "rational decision making affords a bad basis for action" and that "some irrationalities are necessary requirements for organisational actions". In order for action to be efficient the actors require thought, motivation and committment. So "the stronger the expectations, motivation and committment expressed in a decision, the more power that decision exerts as a basis for action (p33). The classical proposal that all alternatives should be considered before making a decision is undesirable from an action point of view because searching for all the alternatives evokes uncertainty and uncertainty reduces motivation and committment. Brunsson suggests that in an unprogrammed decision, decision irrationality is of paramount importance for in these instances, motivation and committment are crucial.

Staw (1980) divides rationality into two aspects along

different lines which he calls prospective rationality and retrospective rationality. He suggests that the former (i.e. neoclassical type rationality) is not always present but that the latter, especially in situations where ego defensiveness is dominant, is often present. Staw defines retrospective rationality as the rationalisation of prior behaviour in an attempt to make it appear rational. Bettman et al (1983) observed this tendency when evaluating annual reports of companies in the USA. Pfeffer (1982) says that the role of cognition is "as a mechanism for making sense of or rationalising behaviour that has already occurred". Meyer and Rowan (1977) say that firms at least present an image of rationality not for any goal attainment or efficiency reasons but in order to attain legitimacy in the eyes of the world. It serves a symbolic and ceremonial function to show the world that they are worthy of support and resources.

The latter point is apparently similar to the ideas of Friedman (1953) who suggested that firms need to be rational in order to survive. With an imperfect stock market, imperfect information,. the dispersion of stockholders and the fact that many companies finance expansion internally, survival of the fittest is not always a good maxim as shown by Winter (1964). With imperfect knowledge, firms may have to appear to be rational but information from the organisation concerned may be highly selective, detailing only the good aspects and being retrospectively rational or blaming the environment for bad

times (Bettman 1983)

Simon and Cyert and March put much emphasis on the use of standard operating procedures (SOPs) in facilitating decision making. This is taken up by Mazzolini (1981). The Carnegie School stresses the use of SOPs in programmed decision making. Mazzolini concentrates his efforts on applying the theory to stategic (unprogrammed) decisions. He describes a process view of strategic decision making divided into five main aspects:

1. Decision need identification.

2. Search for alternatives for action.

3. Investigation of courses of action.

4. Reviews and Approval.

5. Implementation.

Each of these aspects is based on processes within the organisation. Thus, identification of the decision need is based on certain agreed upon procedures such as a discrepancy between desired and actual attainment of particular indicators. On the search aspect, set procedures trigger search towards particular areas, neglecting other possible areas. Known paths are always followed and similarities to previous problems are sought so that particular action courses can be adopted. This leads to a tendency towards incremental change and preservation of the status quo. Even when a decision has been made, the

implementation of the decision follows set paths and thus

becomes distorted at each stage of the process. Thus,

"projects that demand that existing organisational units

depart from their established programmes to perform

unprogrammed tasks are rarely accomplished in their design

form". Loasby (1976) found that many firms were attempting

to use existing programmes to tackle strategic problems and

ended up with unsatisfactory incremental change. The same

was found by Allison (1971) in his study of governments.

As was shown above, Simon divides the decision making

process into three phases, intelligence, search and choice.

There have been many variations on the numbers of stages

involved in decision making (see for example Dewy (1933),

Mintzberg (1976), Mazzolini (1981), Lindblom (1959),

Webster (1965), Robinson and Faris (1967)). Whilst most of

the studies include Simon's three basic phases, a common

addition is the phase of actually implementing the decision

once it has been decided upon. Loasby (1976) for instance,

says "a choice is not effective without implementation

which may be far from simple and often imperfectly

accomplished". Loasby therefore specifies a five phase

cycle comprising the following aspects:-

1. sift intelligence

2. direct search

3. evaluate choice

4. guide implementation

5. appraise results.

Simon himself did not totally neglect the implementation stage, but says of it "I shall merely observe by the way that seeing that decisions are executed is again decision making".

The method used for decision making is determined to quite a large degree by the nature of the decision to be made and the type of organisation in which it is made.   One of the recurring themes of the literature determining the nature of the decision is the degree of complexity involved. Mazzolini (1981) points out that decisions take a long time to be processed if the procedures used are complex. Loasby (1976) says that decisions are related to three criteria which in turn are all related to complexity. The criteria are;

1. the width of the agenda i.e. the definition of the systems boundaries.

2. the set of control variables i.e. the distinction between the long run and the short run

3. the degree of programming i.e. the extent to which procedures for reaching a decision is prescribed.

Considering the set of control variables, Loasby advocates that decisions should be treated as capital goods. He says "Just as no firm can afford to replace the plant every time a slightly better design appears, so no firm can afford to change its policy with every slight improvement it may discover. ..... the sunk costs of old decisions are no more

relevant than the sunk costs of old plant". Loasby is also in this statement advocating the rationality of irrationality.

Dess and Beard (1984) also support the view that complexity, this time environmental complexity, is of great importance in decision making. The two other dimensions they consider to be of prime importance are munificence (capacity) and the dynamism of the environment. Complexity in Dess' terms is determined by the degrees of homogeneity/heterogeneity and concentration/dispersion. Astley et al (1982) considering strategic decisions say that decision making depends on both complexity (i.e. the intricacy of the decision) and cleavage (i.e. the degree of disparity of interests between members of the organisation). They work along very similar lines to Simon, except that they believe that decisions are not made purely in response to problems, but are also opportunity related as well as being made in the course of every day activity. Astley et al show from their sample of 150 case studies, that satisficing and incrementalism ensue from the inherent complexity of the topic for discussion and from the political cleavages of those who wield power.

Mintzberg et al (1976) also follow sharply the lines of the Carnegie School, although, like Astley et al above, they regard decisions as arising from opportunities as well as from crises and problems. Mintzberg's writings concern the internal politics of organisations (or the cleavage),

which they believe affect the simplicity of the decision
making process. They say that political activities
"reflect the influence of individuals who seek to satisfy
their personal and institutional needs by the decisions
made in an organisation". Although Mintzberg et al suggest
this increases the complexity of the process, he says also
that they can serve to "clarify the power relationship in
the organisation" and that "they can help to bring about
consensus and to mobilize the forces for the implementation
of decisions". According to Mintzberg et al, the outcome
of the situation is the appearance of bargaining.

The decision process is viewed by Mintzberg as being
dynamic and not continuous as he says the Carnegie School
implies (though it could be argued that they treat the
dynamism of the process quite thoroughly, for in their
model they include many cycles, recycles and delays).
Mintzberg says that the decision making process is
characterised by six groups of dynamic factors:

1. interrupts (caused by environmental factors)

2. scheduling delays

3. timing delays and speedups

4. feedback delays

5. comprehension cycles

6. failure cycles.

All these dynamic factors serve to increase the complexity
of the decision process.

In the Carnegie School model, information is screened at
the boundaries and at every level of the organisation so
that information that is obviously unnecessary or that does
not fit neatly into any SOP does not penetrate the system.
Huber (1982) elaborates quite extensively on the passage of
information through organisations. He considers four major
potential internal information distortion sources and their
interrelationship with internal variables. The distortion
sources are:

   1. the probability of information being routed to the
correct location;

   2. the probability of message delay

   3. the probability of information summarisation and

   4. the probability of information being modified en
route.

The outcome is a series of 24 propositions. For instance,
the probabilty that a message will be routed to a unit is
inversely related to the perceived costs of communicating
with that unit, the workload of the unit and the goal
attainment that the sending unit believes will occur as a
result of the routing, and is positively related to the
perceived relevance of its content for that unit, the
perceived power and status of the unit and the frequency
with which similar messages have been routed to the unit in
the past.

Thus Huber, working within an organisational decision
making theory has expanded on one particular element of the

theory; informational bias. With such a high level of bias in organisational decision making, both intended and unintended, it is difficult for management to obtain a clear view of the objective situation for as Wildavsky (1983) says "whichever way they (management) go, error is endemic; if they seek original sources they are easily overwhelmed, if they rely on what they get, they are easily misled". Wildavsky was concerned with the dilemna posed by management information systems which produce a great deal of information, making it difficult to reduce data to manageable levels. The greater availability of data means that there is a greater probability of it being lost or misinterpreted and this is so partly because there is less time for each bit of output to be analysed. Feldman and March (1981) were also interested in this problem. They looked at the tendency for organisations to collect much more information than they could actually use or reasonably expect to use in the making of a decision, while continuously asking for more information or complaining about the content of existing information. They proposed four reasons for the overgathering of information:-

1. organisations provide incentives for gathering information

2. much of the information is treated in a surveillance mode rather than in a decision mode.

3. much information is subject to misinterpretation and

4. information use symbolises a commitment to rational

choice.

Information also gets distorted for other psychological reasons such as the attributes of the receiver, selective perception, semantic problems and time pressures (Wallace and Szilagyi 1983). All these factors introduce unintended bias. Decisions can be further distorted by internal factors such as the mistrust of a source of information which makes the information incredible; defensive behaviour on the part of one or more of the members of the organisation who act as disadvantageous filtering agents; erroneous translation of information; distortions from the past because the new situation cannot be considered 'de novo'; or lack of congruence between aspects of the firm's or its members' activities (Hampton and Summer 1982). There is little possibility with all these potential sources of information distortion that a decision could be made on rational (in the classical sense) grounds. The decision makers will be truly 'bound'.

Leibenstein, although not fully in accordance with the Carnegie School suggests that inefficiency may be rife in an organisation. Leibenstein (1966) calls his version of inefficiency 'X-inefficiency' - which is an all inclusive term to cover inefficiency not accounted for by allocative inefficiency (i.e. inefficiency arising from the existence of monopoly power). X-inefficiency results from the simple fact "that neither individuals nor firms work as hard, nor

do they search for information as effectively as they could".

There are three elements of X-inefficiency:-
1. intra plant motivational efficiency
2. external motivational efficiency
3. non market input efficiency.

In Leibenstein's model, individuals are selectively rational and there exists conflict reducing factors such as inert areas and effort discretion. An individual has a certain personality which determines the degree of responsibility desired and how much pressure he enjoys. However, there are pressures from both peers (horizontal pressure) and authority (vertical pressure) which also determines the overall degree of pressure to maximise. The third element is partially explained by the existence of imperfectly specified job contracts which means that " a good deal is left to custom, authority and whatever motivational techniques are available to management as well as to individual discretion and judgement". The result of these three pressures determines the extent of selective rationality of an individual.

With imperfectly specified contracts, the individual has effort discretion over his activities, pace of activities and sequence in which they are performed. Additionally, an individual will not move from one position if the costs of moving are insufficient to compensate for the gained

utility of the move. This is termed an inert area. As organisational entropy increases, there is an increasing degree of disorganisation and individuals find effort points that they desire where control over their activities is weak. Thus inefficiency increases the cost of production, whilst at the same time allowing for the existence of a multitude of different individual goals.

There are two major differences between the Carnegie School theory and the one propounded by Leibenstein; the first concerns inefficiency and the second the level of analysis.

In the Carnegie school model, organisational slack occurs as a result of satisficing as opposed to maximising. The outcome in both cases appears to be the same although what would be called X-inefficiency in Leibenstein's terms does not necessarily coincide with organisational slack because of the aspiration level involvement in the latter concept. In both cases the 'inefficiency' is a desired outcome and both appear to agree that the level of inefficiency depends on the economic climate and motivational factors. Leibenstein does not, however, seem to accept that minimum costs will differ over time, which results in his view of cost cutting exercises as being evidence of inefficiency from the outset.

Leibenstein calls his theory a micro-micro theory because

it relates to individuals rather than to the firm as a unit. He refers to Simon's model as semi-micro-micro and says that although "it contains an extremely rich set of ideas about the internal operations of firms...... it is not a general model and does not present a theory of how the internal conflicts of the firm are resolved".

Day (1975) summarises the characteristics of Carnegie School model thus:-

1. satisficing

2. bounded rationality

3. multiplicity of goals

4. sequential attention to goals

5. feedback

6. SOPs

7. resistance to change

8. coalitions to resolve conflicts

9. organisational slack to stabilise conditions

10. maintenance of viability.

Leibenstein considers that only points 8 and 10 are necessarily related to essentially micro-micro approach. He goes on to say that the the Carnegie School are not primarily concerned with disassembling the black box of standard theory. They are, nevertheless, within the boundaries of micro-micro theory.

The two theories appear to be essentially complementary

and not in opposition.

There is, then, a considerable body of literature on the
behavioural theory of the firm. This literature is
summarised at the end of the chapter where it is developed
into a theoretical conceptual model. First, however, its
importance and relevance is illustrated by demonstrating
some of the applications in which it has been used.

4.3. <u>Applications of Behavioural Theory</u>

Although behavioural theory has never been applied to the
costing and pricing of road freight transport, it has been
used in related areas. This section briefly reviews some of
the important literature on those applications. It is not
meant to be an all encompassing review, its purpose is merely
to demonstrate the scope of the theory and the importance and
relevance of its contribution.

One of the most widely accepted applications of behavioural

theory is in the area of organisational buying behaviour
(OBB). The literature on this subject is now at quite an
advanced stage and for the purpose of clarity and parsimony,
this review will be confined to some of the earlier
contributions to the subject, which effectively form the
'core'. OBB focusses on the complexities of the buying
decision and the relationship betwween the internal variables
of the firm, the actions involved in the decision and the
environmental factors involved.

A state of the art literature review was done by Gray
(1980). According to him, it was an article by Webster in
1965, which was highly influenced by Cyert and March (1963)
and the earlier behavioural work as described above, that
sparked off much of the interest in OBB. Webster believed
that since buying decisions were made by individuals
functioning as part of an organisation, to understand the
buying decision, both individual and organisation decision
making must be studied. He saw the buying process as
comprising four stages, much like that of Simon. They were
1) problem recognition, 2) buying responsibility, 3) search
process and 4) choice process.

Robinson and Faris (1967) divide the buying situation into
three 'buyclasses'; 1) new task i.e. a purchase is made
based on a new set of conditions, 2) a straight rebuy i.e
a purchase where the conditions have not changed since the
previous purchase and 3) a modified rebuy i.e. where
conditions have changed slightly since the last purchase.

Each time a purchase is anticipated, the decision makers go through eight 'buyphases' a) recognition of the problem or anticipation of a problem, b) determination of the characteristics and quantity of the needed item, c) description of the characteristics and quantity of the needed item, d) search for and qualification of potential sources, e) acquisition and analysis of proposals. f) evaluation of proposals and selection of suppliers. g) selection of order routines, h) performance feedback and evaluation. Thus according to Robinson and Faris, the decision making process varies according to the type of purchase made and proceeds through a continuous process of problem solving. The decision makers are by no means globally rational and search is confined to seeking satisfactory outcomes.

Webster and Wind (1972), disappointed with the fragmentary nature of some of the preceding models, propose an integrated model for dealing with OBB. Gray describes the model as "encompassing variables based on the individual person, the social group, the organisation and the environment". Those who are involved in the purchase decision are described as the 'buying centre' and have one or more of five roles; user, influencer, decider, buyer and gatekeeper. Variables relating to the buying decision are divided into 'task' and 'nontask' variables, task variables being those directly related to the buying task (e.g. price) and nontask being those less obviously related to the task (e.g. motives). Thus they are allowing for the influence of many variables on the decision makers and for potential conflict.

Sheth (1976) is concerned with including both variables within the firm and external to the firm in his model. He says that the decision making process will depend on four classes of purchasing situations, the type of purchase involved, the business climate at the time of purchase, the relationship between specific individuals involved in the purchase, on both buying and selling sides and the legal-political considerations.

This brief exposition of a fraction of the literature on OBB shows how behavioural theory has been adopted and applied to one specific area. The literature stresses the importance of many factors (internal firm variables, environmmental variables, type of purchase, reason for purchase, etc.) which together combine to affect the way decisions are made. Other works of a similar nature include Nicosia and Wind (1977), Bonoma and Johnston (1976), Ferguson (1978), Ozanne and Churchill (1971), Newall (1977), Luffman (1974), Hillier(1975) and more recently Cardozo (1983), Crow and Lindquist (1982) and Thomas (1982).

Freight transport modal choice is essentially a buying decision. It is not surprising, therefore, that work done on OBB has been applied to modal choice decisions. The first such link was made by Saleh and Lalonde in 1972. They looked at carrier selection in the U.S. using the 'buygrid analysis' framework of Robinson and Faris. Six characterising dimensions of the 'straight rebuy' and 'modified rebuy'

situations were considered. These were 1) the newness of the
problem to the buying influencers and decision makers, 2) the
amount of ideation or cognition spent by the decision maker
in analysing the buying situation, 3) the extent of
information seeking activity displayed by the buyer, 4)
whether or not new alternatives are given serious
consideration by the decision makers, 5) the latency of
response and 6) the appropriate criteria employed in
approaching the buying or selection decision. Based on
results from a detailed questionnaire, they found that 1)
shippers evaluated very few carriers before deciding, 2) they
do only a moderate amount of external search, 3) they
considered "only the carrier with whom they have maintained a
long and satisfactory relationship and no-one else". If not,
only between 2-5 carriers were considered, 4) used between 3
and 6 features for evaluating carriers services and 5)
satisficed as opposed to optimized. All these findings are
supportive of the behavioural theory.

Cunningham and Kettlewood (1975) considered source loyalty
and modal image, particularly in relation to the implications
for British Rail. They were seeking to discover what
brought about modal switch and the part played by the image
of the supplier. They found that a modal switch was only
considered when a shipper was dissatisfied with the service he
was obtaining and that British Rail were suffering because
shippers' perceptions did not correspond with reality. A
study by the same authors in 1975 again considered source
loyalty and constructed a set of six hypotheses based on the

literature of OBB and behavioural theory. They hypothesised that source loyalty would be strong due to: 1) the low pressure for cost savings due to the low essentiality of transport in terms of its contribution to the organisation's overall profitability; 2) the allocation of transport buying authority to a member of the organisation as a secondary function; 3) the desire to reduce personal risk due to the heavy involvement of others in the transport process; 4) the desire of the buyer to reduce and simplify his work by reducing the search for alternatives and delegating the short term procurement of services; 5) the influence of the consignee in the buyers' decisions by specifying the mode of transport preferred; 6) the availability of existing facilities whose use is confined to a particular mode and the need for investment in new facilities required for an alternative mode.

Their hypotheses thus stressed both the importance of the individual and the situation with which they were faced and thus are supportive of the behavioural theory.

Behavioural research in the areas of buying and modal choice has far reaching implications for marketing and policy decisions, and has made a considerable contribution to the knowledge on decision making behaviour. The nature of the relationships between the various behaviour influencing factors are clearly recognised enabling behaviour to be modelled and used to predict reactions to changes in circumstances and conditions. A similar approach to costing

104

and pricing of road freight transport would be of equal importance.

4.4. Summary and conceptual model

It has been shown above that behavioural theory has much to commend itself as a theory of decision making behaviour. Its flexibility has been demonstrated through its application to one particular area of behaviour - that of OBB. This final section summarises the behavioural approach in a self-explanatory diagrammatical form and in so doing develops a theoretical conceptual model. This step is important as it forms the framework against which road freight transport costing and pricing operations can be compared. The relevance of the model to freight operations will be dealt with in the following chapter; this section confines itself solely to the theoretical aspects.

The behavioural approach disaggregates into three levels of analysis as shown in fig 4.2

FIGURE 4.2

THREE LEVELS OF ANALYSIS IN THE BEHAVIOURAL APPROACH
(THEORETICAL)

Central Proposition

Operational Processes

Methodological Processes
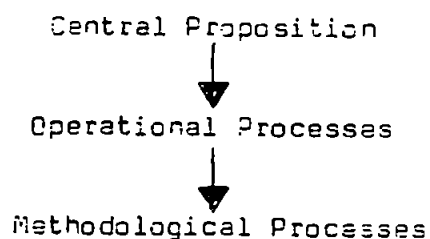
The central proposition is the source of the theory; the operational processes are the direct consequences of the central proposition and the methodological processes are the means by which the operational consequences are achieved. Probably the best method of explanation is by direct recourse to the behavioural theory which breaks down into the following three levels:

FIGURE 4.3

THREE LEVELS OF ANALYSIS IN THE BEHAVICURAL APPROACH
(ACTUAL)

```
                    ┌──────────────────────┐
                    │ Firm is a coalition  │
                    │ of members with      │
                    │ bounded rationality  │
                    └──────────────────────┘
            ┌──────────────┴───────────────────────────┐
    ┌───────────────┐                      ┌──────────────────────┐
    │ Goal formation│                      │ Aspiration level set │
    └───────────────┘                      └──────────────────────┘
   ┌──────┬─────────┬──────────┐        ┌──────────────┬──────────────┐
┌─────────┐ ┌──────┐ ┌──────────┐ ┌──────────────┐ ┌──────────────┐
│Uncertainty│ │Search│ │Conflict  │ │Organisational│ │Information   │
│reduction  │ │      │ │resolution│ │adaptivity    │ │handling      │
└─────────┘ └──────┘ └──────────┘ └──────────────┘ └──────────────┘
```
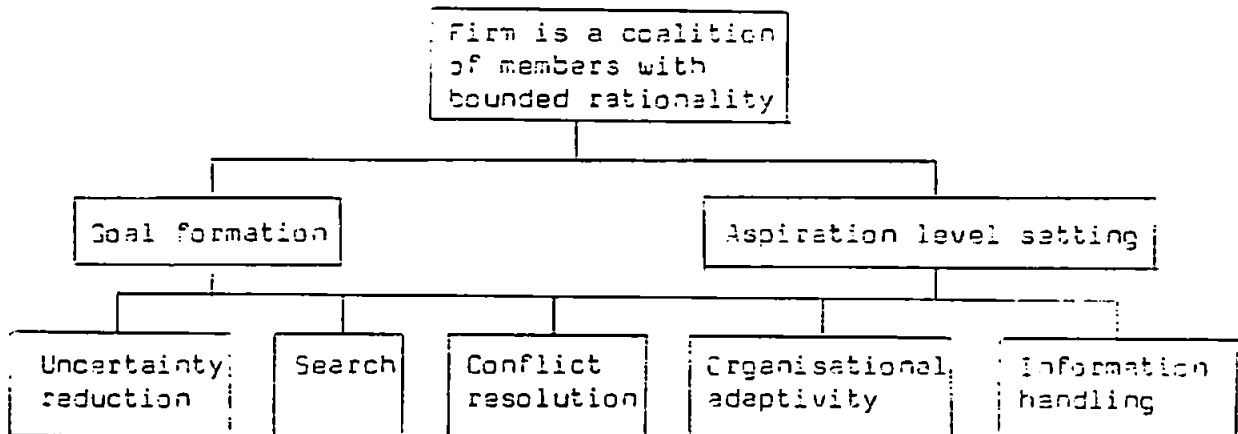
Thus the central proposition of the behavioural theory is that the firm is a coalition of members with bounded rationality as opposed to a monolithic agent with global rationality as assumed by the neoclassicists. A direct consequence of the central proposition is that profit maximisation is not the sole objective of the firm, nor is it even attainable. Instead goals are formulated through a process of bargaining and the desired level of performance on these objectives (the aspiration levels) are determined iteratively. Goal formation and aspiration level setting are, thus, the operational processes since they provide the raison d'etre for the firm given the central proposition. The actual levels of achievement are a function of the workings of the methodological processes which are also an input into the operational processes. Methodological processes are the day to day work processes and, except for information handling, correspond to Cyert and Marchs'

relational concepts.

Each of the processes is described in more detail in diagrammatical form in the following pages. The section culminates in a flow type diagram which depicts the interrelationships between the various constituent blocks. The diagram differs somewhat from the usual flow diagram in that it depicts flows of different levels of analysis. However, despite this, it serves ·the useful purpose of bringing together the various aspects and enabling the exposition of the overall picture. This forms the conceptual model.

FIGURE 4.4

ASPIRATION LEVEL SETTING

(A) STATIC VIEWPOINT
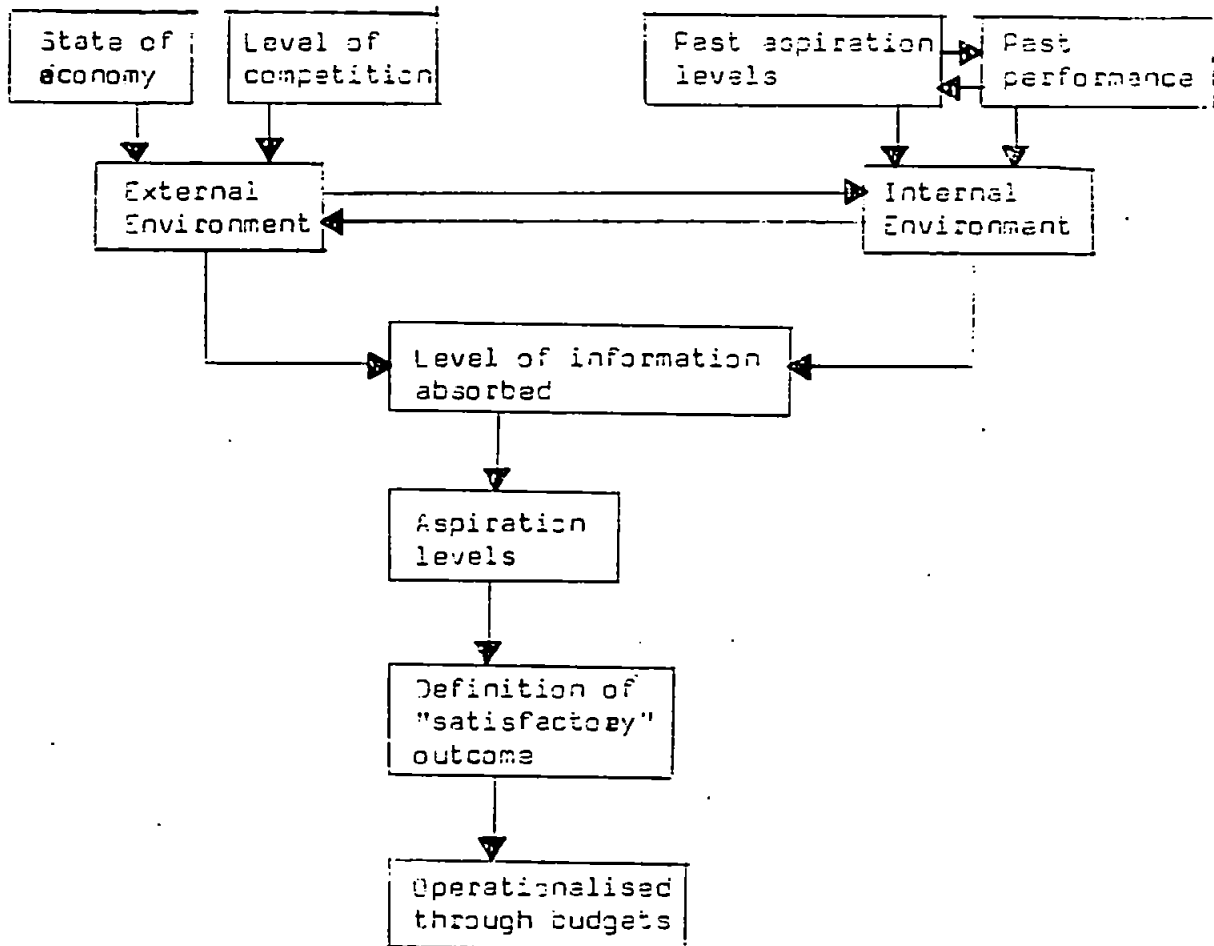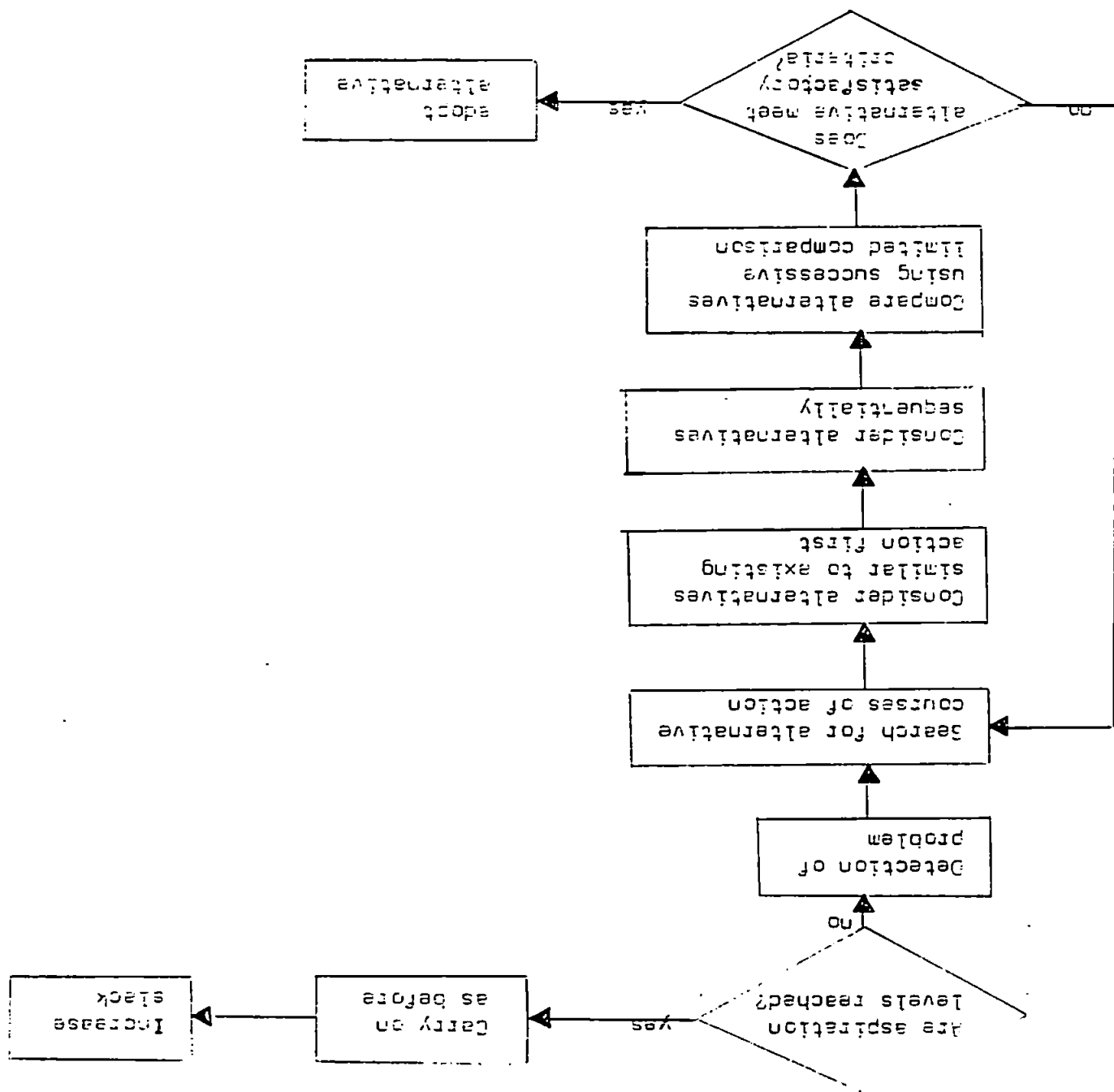
```
┌──────────┐ ┌──────────┐        ┌──────────────┐ ┌──────────────┐
│ State of │ │ Level of │        │ Past aspiration│▶│ Past         │
│ economy  │ │competition│       │ levels       │◀│ performance  │
└────┬─────┘ └────┬─────┘        └──────┬───────┘ └──────┬───────┘
     ▼            ▼                      ▼                ▼
  ┌──────────────────┐            ┌──────────────────┐
  │ External         │───────────▶│ Internal         │
  │ Environment      │◀───────────│ Environment      │
  └────────┬─────────┘            └──────────────────┘
           │                              │
           │      ┌──────────────────────────┐
           └─────▶│ Level of information     │◀───┘
                  │ absorbed                 │
                  └────────────┬─────────────┘
                               ▼
                        ┌──────────────┐
                        │ Aspiration   │
                        │ levels       │
                        └──────┬───────┘
                               ▼
                        ┌──────────────┐
                        │ Definition of│
                        │ "satisfactory"│
                        │ outcome      │
                        └──────┬───────┘
                               ▼
                        ┌──────────────┐
                        │ Operationalised│
                        │ through budgets│
                        └──────────────┘
```

FIGURE 4.6

GOAL FORMATION

Goal constraints
imposed by
active members

active
member
goal
conflict

Goal constraints
imposed by
subunits

subunit
goal
conflict

individual
goal
conflict

goals of
firm

Bargaining

goals
of
individual

goals of
subunits

goal
agreement
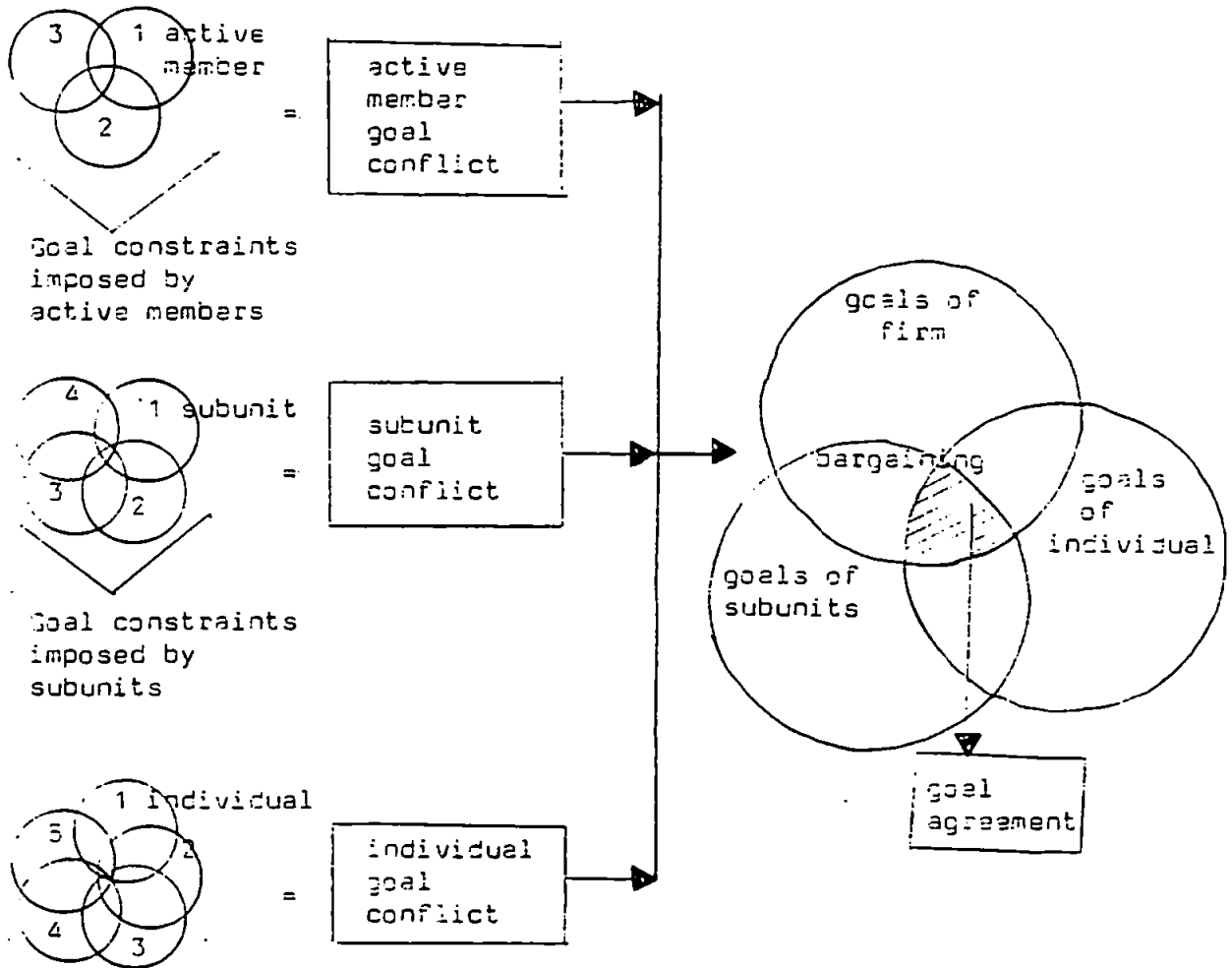
FIGURE 4.7

CONFLICT RESOLUTION

```
                    ┌─────────────────┐
                    │  Goal conflict  │
                    └────────┬────────┘
                             │
                             ▼
                    ┌─────────────────────┐
                    │ Conflict resolution │
                    │ mechanisms          │
                    └──────────┬──────────┘
                               │
        ┌──────────┬───────────┼───────────┬───────────┬──────────┐
        ▼          ▼           ▼           ▼           ▼          ▼
┌────────────┐┌─────────┐┌───────────┐┌───────────┐┌─────────────┐┌────────────┐
│Satisficing ││ Budgets ││ Slack and ││Sequential ││Decentralised││ local      │
│            ││         ││policy side││attention  ││decision     ││rationality │
│            ││         ││payments   ││to goals   ││making       ││            │
└────────────┘└─────────┘└───────────┘└───────────┘└─────────────┘└────────────┘
```
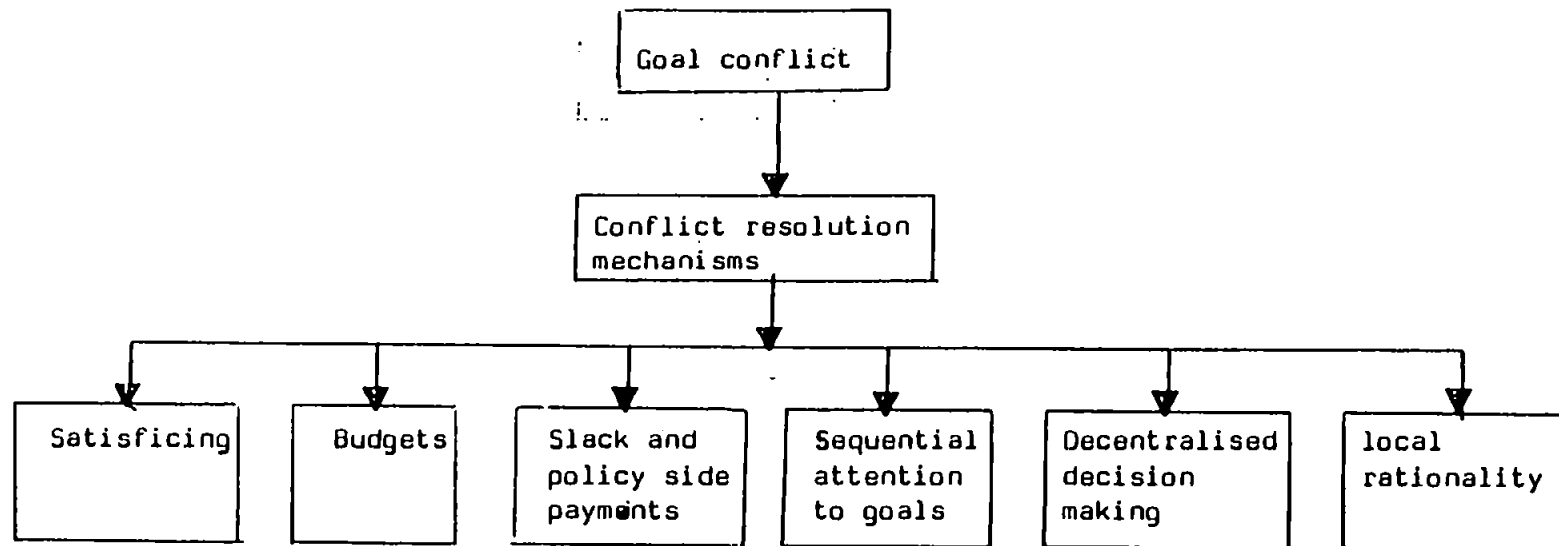
FIGURE 4.8

UNCERTAINTY REDUCTION

```
                    ┌──────────────┐
                    │ Reduce       │
                    │ Uncertainty  │
                    └──────┬───────┘
                           │
                           ▼
    ┌──────────────────────┼──────────────────┐
    ▼                      ▼                   ▼
┌──────────────┐  ┌──────────────┐  ┌──────────┐   ┌──────────────┐   ┌──────────────┐
│ Use          │  │ Negotiate    │  │ Use      │   │ Activity     │──▷│ Incremental  │
│ Simplified   │  │ the          │  │ SOPs     │   │ becomes      │   │ change       │
│ models       │  │ Environment  │  │          │   │ routinised   │   │              │
└──────┬───────┘  └──────┬───────┘  └─────┬────┘   └──────▲───────┘   └──────────────┘
       │                 │                │               │
       ▼                 ▼                ▼               │
       └─────────────────┴────────────────┴──────────────┘
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FIGURE 4.3

INFORMATION HANDLING

FIGURE 6·10

CONCEPTUAL MODEL

115
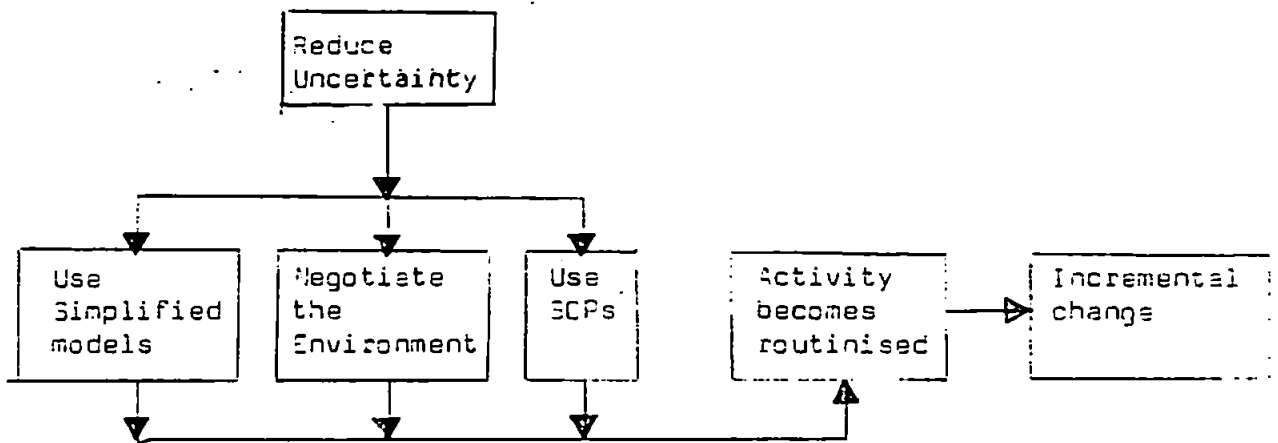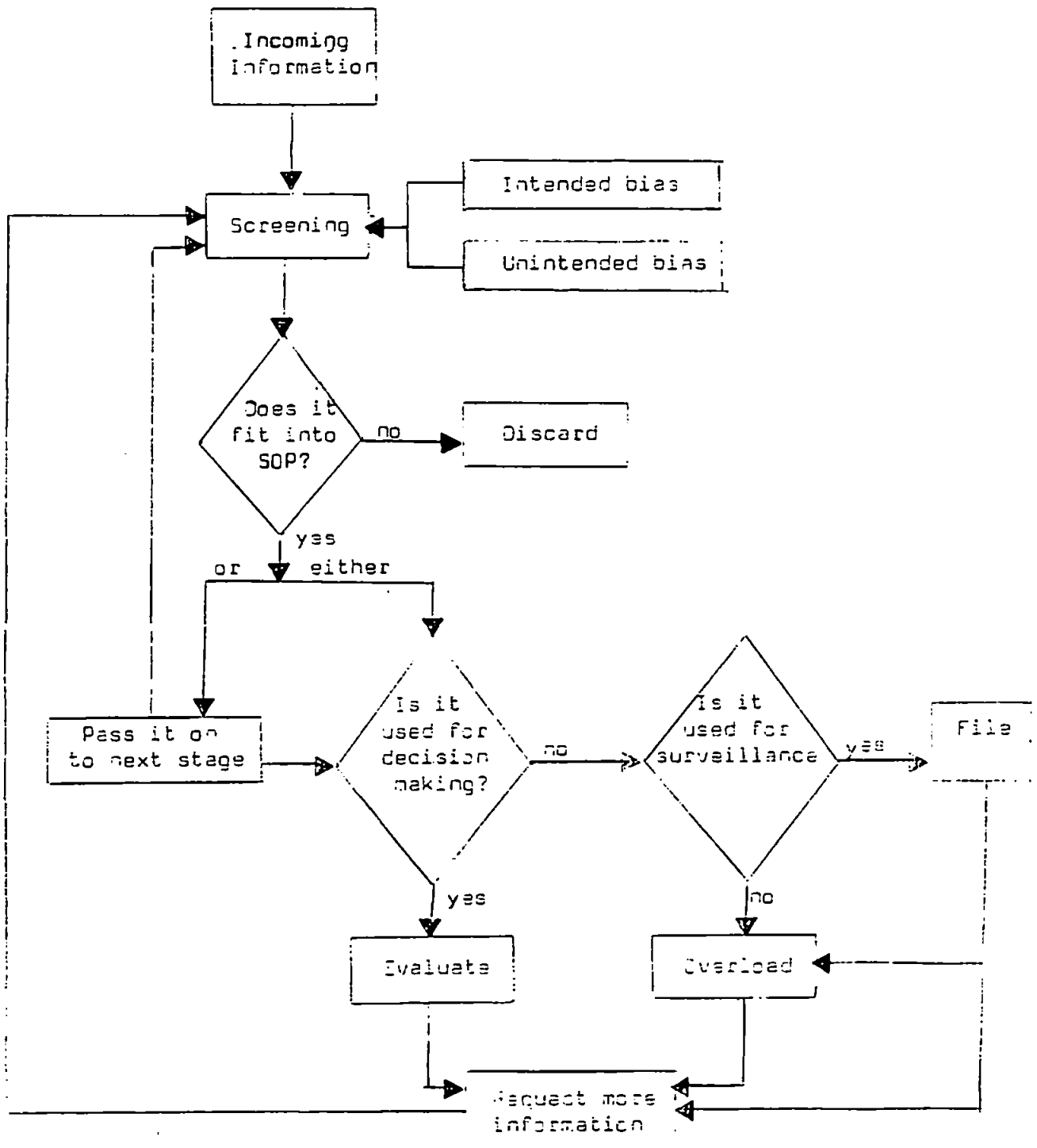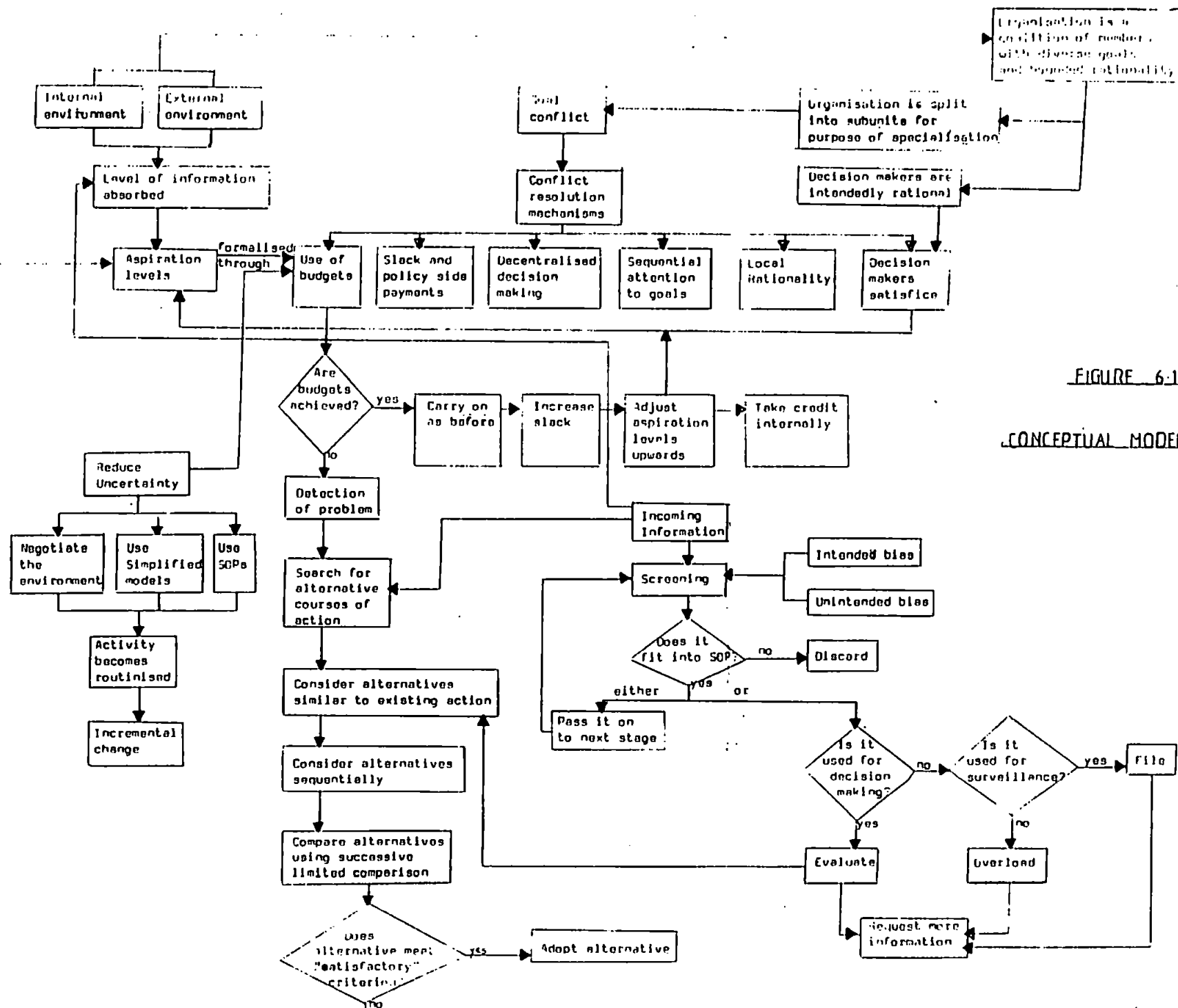
CHAPTER 5 .

RELATING OPERATORS' COSTING AND PRICING METHODS AND APPROACHES TO BEHAVIOURAL THEORY. RESULTS FROM AN IN-DEPTH SURVEY OF 18 FIRMS.

5.1 Introduction

The major gaps in the knowledge of road freight transport operating costs have been identified in the previous chapters, along with the potential relevance of the behavioural theory to this area. The purpose of this chapter is to gain a thorough understanding of the costing and pricing methods and approaches used by road freight transport operators and to discover the extent to which they are supportive of the behavioural theory. The chapter is, thus, an exploratory chapter. It starts with a description of the research method used and outlines the advantages of this methodology for this particular study. It then continues by giving an exposition of the results obtained. A discussion of the applicability of these results to behavioural theory follows in the third section. It is shown that operators' approaches to costing and pricing are consistent with the theory. The chapter concludes by proposing a model of the determination of costs and prices based on the behavioural theory and the observations made.

5.2 Research Method

In order to achieve a detailed understanding of road
freight transport operations and specifically of the
costing and pricing methods used, a qualitative preliminary
study was necessary. According to Chadwick et al (1984),
the general advantages of a qualitative type approach is
that it:

1. involves observation of behaviour in its natural setting.
   A researcher deals with subjects and their world;
2. aids understanding of the interviewee's world,
3. is more flexible; the line of attack can be changed.

Thus, qualitative research is designed "more to determine
'what things exist' than to determine how many such things
there are." (Walker 1985). As this was an exploratory
exercise, it was answers to these 'what' and 'why' type
questions that were of paramount importance. A postal
survey, although advantageous on cost and time grounds,
would have been impractical for this purpose. Precise
detail of the data required was not known in advance, nor
was it known how much information transport providers would
volunteer on such sensitive issues as costing and pricing.
Furthermore, a postal survey would not have provided
information on the approaches and reasons for operators'
actions. In order to relate costing and pricing to
behavioural theory, it was necessary to gain an
understanding of the decision-making process, not solely to

obtain answers to specific questions. This could only really be achieved by observations of and interviews with operators in their work environment.

Although much valuable information can be obtained from an intensive study of the decision making process of a single firm, the nature of behavioural theory suggests that the operations of several firms needed to be observed, as each firm was likely to have a different method of approach. It was considered that an appropriate range could be observed by visiting about 20 firms, divided equally between hire or reward and own account. This number was also compatible with the time and budget constraints of the project.

Freight transport studies of this nature (i.e. short but detailed studies of a small number of firms) have also been carried out by Cook (1967), Patterson and May (1981), Cooper and Doganis (1982), Cooper and Doganis (1985), Rowley et al (1983), Glover (1983) and Pike (1982)

A cross section of operators, whose names and addresses were provided by the Road Haulage Association and the Freight Transport Association, were contacted by telephone and preliminary visits were made to acquaint them with the value of the proposed work and the information required. A micro computer was taken on each visit. Many of the firms at this time had no computer (or at least were only using

them for administrative purposes) and were interested to see what functions it could perform and how it could help them. A display of the advantages of a simple spread sheet package helped to elicit the good will of the operators and stressed the potential for mutual benefit.

Eighteen operators agreed to cooperate with the research. The support of the FTA and the RHA was particularly influential in their decisions to do so.

The operators chosen did not constitute a representative sample. Given the task at hand and the sensitivity of the subject matter, it seemed prudent to contact operators who were recommended by the two professional bodies as being friendly and cooperative, rather than to obtain a representative sample but obtain little cooperation and, therefore, little information. Again this follows the approaches of most of the studies referred to above.

There are two main sources of bias associated with this approach. First, since the research only included 'respectable and professional' operators recommended by the RHA and FTA, little would be seen of the 'cowboy' element so often alluded to. Second, the firms recommended were all larger than the average operator. Since the study was mostly exploratory, however, these biases are not of great importance. The operators still formed a good cross section, carrying a wide range of products, from beer to concrete. The size of the firms in terms of numbers of

office staff employed in the transport departments, numbers and sizes of vehicles and activities covered, are shown in table 5.1 along with the major products carried.

The sources of bias referred to above are specific to this project. Qualitative research in general is open to many other sources of bias in data collection due to both the interviewee and the interviewer. McCall (1960) states that there are six major factors relating to the interviewee to be aware of:

a) Knowledgeability - did respondents give direct, firsthand knowledge? Is there confidence in his objectivity?

b) Repertorial ability - was the interviewee properly able to express himself well, in detail, and on issues which may seem obvious to himself?

c) Reactive effects of the interview situation - did the interviewee seem strained? - did he withold data?

d) Ulterior motives - was the interviewee trying to rationalise or slant the results?

e) Bars to spontaneity - did the interviewee seem over anxious about the possibility of being overheard?

f) idiosyncratic factors - subject's immediate mood, drink etc.

Chadwick et al (1984) add, relating to the interviewer and concerning the observational element:

1) the sheer inadequacy of human sense organs.

TABLE 5.1.

FIRM	No. office staff in transport	Number and weights of vehicles	Activities of firms	Main product hauled
Hire or reward				
1	8	4 x 32t artics on general haulage 22 x 7.5t (distributor) 14 x 3.5t (contracted) 8 various	Haulage, distribution, rental, contract hire, storage, garage* and diesel sales	Beer, timber and steel products
2	5	7 x 32t artics 9 various	Haulage, storage, cement works, training scheme, derv sales	Televisions, cement
3	18	17 x 38t artics 9 x 32t artics + 36 others 23 x 32t artics (rentals)	Haulage, garage, derv sales, contract hire, forecourt	Quarry materials
4	2	4 x 32t artics 2 x 38t artics 2 others	Haulage	Fruit and vegetables, machinery
5	4	17 x 32t artics	Haulage, garage	Chimneys
6	3	5 x 32t artics 1 x 38t artics 1 x 36t artic 4 others	Haulage, garage	Steel, construction plant
7	4	15 x 38t artics 7 x 32t artics 12 others	Haulage, storage, distribution	Tinned food, dairy produce
8	7	7 x 38t artics 8 x 32t artics 8 x 30t rigids 10 various	Haulage, storage, distribution, derv sales	Coal, sand, toys
9	8	51 x 32t artics 8 x 38t artics 58 x 16t rigids	Haulage, distribution, garage	Milk, oil

* Garage in this table means repairing other vehicles as well as their own.

TABLE 5.1 - CONTINUED

FIRM	No. of office staff in transport	Number and weights of vehicles	Activities of firms	Main product hauled
Own account				
10	4	22 x 38 tonne artics 5 x 32 tonne artics 2 x 16 tonne rigids 9 x 3.5 tonne rigids 38	Producer and distributor of alcoholic drinks	Alcoholic drinks
11	1	2 x 38 tonne artics 1 x 32 tonne artic 1 x 24 tonne rigid 4 x 16 tonne rigid 8	Catch fish, buy fish and distribute it	Fish
12	4	1 x 38 tonne artic 12 x 30 tonne rigids 1 x 30 tonne artic 4 x 28 tonne rigids 4 x 24 tonne rigids 3 concrete mixers + others 31	Quarriers, road construction and hirers of farm spreading equipment	Stone
13	4	12 x 30 tonne artics 17 x 10 tonne vehicles 29	Producers and distributors of alcoholic beverages. Garage.	Beer
14	4	19 x 32 tonne artics 5 x 24 tonne rigids + many delivery vans 24+	Food manufacturers	Food
15	3	1 x 32 tonne artic 5 x 30 tonne rigids 5 x 24 tonne rigids 10 x 16 tonne rigid 21	Producers of animal foodstuffs	Animal foodstuffs
16	4	9 x 32 tonne drawbars	Manufacture hazardous chemicals for household/ business use	Chemicals
17	2	3 x 32 tonne artics 26 x 16 tonne rigids	Produce beer and distribute many types of alcohol	Beer
18	Approx. 14	4 x 38 tonne artics 42 x 32 tonne artics 56 x tippers (various weights)	Quarriers, engineering, garage, derv sales, bodybuilders, waste disposal and	Quarry materials, machinery and coal

122

Observer fatigue and boredom. Also the observer may

misinterpret what is observed because only part of

the situation is visible.

  2) selective perception i.e. certain phenomena are

sensed more than others.

  3) senses are poor instruments for making comparisons

because they adjust to conditions, e.g. you get used to

things and fail to notice their significance.

  4) our senses do not act independently of our past

experiences.

  5) the very process of observation may influence the

phenomena that are being observed.

    The Open University (1979a) states that the observer

must be aware of the following factors:

  1) their own dress - they must dress to gain their

trust and respect.

  2) differences in approaches because of sex,class, or

culture.

  3) difficulties arising because friendships develop.

  4) problems of when and where to take notes.

  Thus, there are many potential pitfalls of which to be

aware when conducting qualitative research. Awareness of

the existence of the problems is probably the most

effective way of overcoming them. Obviously, there will

always be bias, intended or unintended, but at least with

an awareness of it, it can be minimised.

Visits lasting between two and four days, often involving overnight stays, were made to each of the eighteen firms over a period of six months. Each visit resembled a mini fieldwork trip, which the Open University 1979b) describes as "observation of the culture in its natural habitat. This involves learning the language of the people and talking at length to a variety of informants in a natural conversation." Each visit lasted as long as it took to observe the actual process of costing and pricing and to interview all the relevant decision makers. This partly depended on the size of the firm, as this dictated the range of activities to observe and the number of people to interview. Interviews with and observations of approximately sixty decision makers in the areas of costing and pricing and related areas were conducted.

Interviews can be placed on a continuum between stuctured and exploratory, though as Walker (1985) states 'no interview will ever be totally unstructured because the interviewer appraises the meaning of emerging data for his problem and uses the resulting insights to phrase questions that will further develop the implications of these data.'

The interviews conducted were of an exploratory nature which Chadwick et al (1984) describe as 'a situation where the researcher has some rather specific topics that are to be covered and these are included in an interview guide. However, the exact manner in which the questions are asked

and their sequence are determined in the course of the interview itself - the guide is used to make sure that all of the issues of concern receive attention during the course of the encounter but the interview itself remains unstructured.' This describes precisely the method used. The interview guide consisted of a list of approximately 40 questions (see appendix 2) to which, during the period of the visit, answers were sought.

Although the time taken to gain acceptance and trust varied between firms, all the operators were extremely cooperative, providing all the information required and generally allowing access to any documentation desired. The only problem encountered was that some of the operators did not wish for documents containing rates and costs to be photocopied.

5.3 Results

5.3.1 Costing

The transport providers had a variety of methods of costing, ranging from the practically non-existent to the quite elaborate. The first step in a thorough costing system is a cost framework within which to work, consisting of a list of standing and running costs. If no such framework exists, it can be assumed that no formal costing

is done.   Thirteen of the eighteen firms used a cost framework.   Those who did not gave a variety of reasons for not doing so, as shown in table 5.2.

The main reason offered by the H/R operators for doing no costings was that they could not obtain the rates implied by the costs. They regarded the market as a consumer's market and believed that unless the economic climate improved, transport users would always be able to dictate rates.   As they could see no reason for calculating costs other than for setting rates, they regarded costing as a time-consuming waste of effort. Additionally, many hauliers had entered the market because they enjoyed the practical side of transport.   The costing process was disliked because of its administrative nature.

The main reason offered by the O/A operators for doing no costings was that service to their customers was the principal concern and would have to be provided irrespective of costs. Costing was, therefore, irrelevant.

Operators who did no formal costings nevertheless believed they had an accurate knowledge of their costs.   They could quote costs per mile for all the various vehicles in their fleet.   When asked their opinions on costing, a typical reply was 'my fleet is small enough to keep a close eye on. I know which vehicles are the heavy derv consumers and which require a lot of maintenance.'   Thus, costing of a kind was done, but it was very 'rough and ready'.

FIRM	Reason for non-use
Hire or reward	
4	Costing pointless because cannot get rates that the costs imply. Experience more useful than costs. Fleet small enough to keep close watch on anyway. Dislike of paperwork. Main customers dictate rates, therefore little use in knowing costs.
6	Costing pointless and time consuming. Rates depend on what market will bear and there is no other reason for doing costs. Difficult to cost spares because as the stock gets older there is no way of costing it accurately.
8	Insufficient time or staff to do costings although recognise the advantages of doing that. Will start in the near future.
Own account	
11	Fleet small enough to keep an eye on. Have enough administration to do without additional work generated by costings. Would not know what to do with them even if they were done. Transport is a service to the product and so costings are pointless.
12	Transport is a service to the product so costings are not necessary. Also there is insufficient time. Cannot see any advantage in costing because the company as a whole is profitable.

All of the operators who did no costings were
owner-managed and employed mostly family members. They
were also all well-established firms, with all but one in
its second or third generation.

Thirteen operators calculated costs formally. In most
cases, one individual was responsible for collecting the
costs from the various source points in the firm and
entering them into a cost framework. The composition of the
cost frameworks used and the detail of their costings
varied tremendously between firms. The complexity of the
costing methods used is shown in fig 5.1 which has four
parts: (a) the composition of the cost frameworks   (b)
the variations in methods of calculation of one cost
element - depreciation (c) the level of detail in the
costing methods used, and   (d) the allocation of fixed
costs amongst the vehicles for costing purposes.

Fig 5.1 (a) shows that there were both variations and
similarities in the composition of the cost frameworks used
by operators. All included basic cost elements such as
wages, maintenance, fuel and tyres. Only two accounted for
inflation and only one included interest. Overall, the H/R
cost frameworks were more comprehensive than those used by
O/A firms, although   there   were   exceptions.   In
several   cases, O/A operators' frameworks consisted only
of running costs and even then, oil was rarely included.
Running costs were often calculated in an ad hoc manner and

TABLE 5.1a

COMPOSITION OF COST FRAMEWORKS

FIRM/ ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		Hire or reward											Own account					
Licenses	•	•	•		•		•		•	•			•		•	•		•
Vehicle hire	•	•												•	•	•		
Insurance	•	•	•		•		•		•	•			•	•	•	•		•
Depreciation	(1)	(1)	•		•		•		•	•			•					•
Garage wages	•		•		•		•		•				•		•	•	•	
Drivers' wages	•	•	•		•		•		•	•			•	•	•	•	•	
Overheads (non specific)	•	•	•		•		•		•						•			•
Interest							•											
Equipment			•				•						•					
Inflation			•															•
Training levy																		
National Insurance																		
Administration		•								•						•		
Fuel	•	•	•		•		•		•	•			•	•	•	•	•	•
Oil	•	•	•		•		•		•					(2)	•			•
Tyres	•	•	•		•		•		•	•			•	(2)	•	•	•	•
Maintenance	•	•	•		•		•		•	•			•	(2)	•	•	•	•
Accidents									•				•	•	•			

(1) If vehicles are hired there will be no depreciation charge. Firms 1 and 2 had a mixture of owned and hired venicles.
(2) Oil, types and maintenance are included in vehicle hire for firm 14.

TABLE 5.1b

DEPRECIATION METHOD USED

FIRM/ METHOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		Hire or reward											Own account					
Tractors over 7 yrs	•	•	•		•		•											8 yrs
Tractors over 5 yrs									•				•				•	
Trailers over 5 yrs													•					
Trailers over 7 yrs	•	•	•				•											
Trailers over 10 yrs									•								•	•
Rigids over 8 years							•		•						5 yrs			
Straight line basis	•	•	•				•		•								•	•
Reduced balance method					•								•					
Current cost basis		•	•				•										•	
Historic cost basis	•				•				•	•			•					•
Residual value 12½%							•	•										
Residual value otherwise					•												•	
No residual value	•						•	•					•					•
Unknown				•		•				•	•	•						
Vehicles hired														•		•		

FIGURE 5.1c

UNIT OF COSTING

FIRM/ METHOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		Hire or reward											Own account					
Total costs of function yearly	*	*	*		*		*		*	*			*	*	*	*	*	*
Running costs of vehicles per period	*	*	*		*		*		*	*			*	*	*	*	*	*
Running costs of vehicles monthly	*	*	*		*		*		*	*					*		*	*
Hire costs of vehicles monthly														*				
Standing costs of vehicles monthly	*	*	*		*		*		*	(1)								*
Per weight category of veh. monthly									*									*
Per weight category of veh. weekly																		*
Per type of vehicle monthly		*																*
Per type of vehicle weekly																		*
Per vehicle monthly			*		*		*		*	*					*			*
Per vehicle weekly							*		*						*			*

(1) Standing cost per weight category of vehicle monthly

FIGURE 5.1d.

ALLOCATION OF FIXED COSTS

FIRM/ METHOD	1	2	3(*)	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		Hire or reward											Own account					
Equally between vehicles	*				*													
Per vehicle according to weight							*											
Per vehicle according to days used							*											
Per vehicle on mileage basis																		
Fixed usage equally btwn vehicles			*															
Per indiv. veh. on actual figures		*																*
Per category of veh. on actual figures			*				*		*	*								

(*) Firm 3 allocated insurance costs in the same ratio as the VED between vehicles

130

were not collated into a framework to show the total
running costs of each vehicle. The firm using a
comprehensive framework and, therefore, doing detailed
costings, was the exception rather than the rule.

Fig 5.1 (a) does not fully illustrate the extent of the
differences in costing between firms. Many items in the
cost framework were treated differently in different firms.
Depreciation is an obvious example of this as shown by fig
5.2 (b). Appendix 3 briefly describes the various methods
of depreciation used. There are three elements of
depreciation worth considering from the cost viewpoint:
1) the book life given to the vehicle   2) the residual
value of the vehicle   3) the method of calculation.

Most of the firms depreciated their vehicles over a
seven year period, though some used a five year period for
their tractors. The O/A firms tended to use a five year
depreciation period.

Because of the uncertainty of the second-hand market for
goods vehicles, residual value was rarely calculated on an
individual vehicle basis. A common policy was to assume
that a lorry would fetch 12% of its purchase price at the
end of its life. Another common policy was to assume no
residual value at all. This was done 'to be on the safe
side'.

A mixture of straight-line and reducing balance methods

of calculation were used by the operators. Some transport
managers used a different method of depreciation from
their accountants. Transport managers tended to use the
easier, but arguably less accurate, straight-line method.
In most cases, historic costs rather than current costs
were used.

In general, the transport managers seemed to have a poor
understanding of the principles of depreciation. In fact,
some looked quite bewildered at the mere mention of it and
could not say which method was used or what assumptions
were made on the residual value of their vehicles.

Parts (c) and (d) of Fig 5.1 show the detail of costing
approaches adopted by the firms. Detail is a function of
the number of cost elements included and the frequency with
which they are taken into account. In fig 5.1 (c) the level
of detail increases progressively down the rows of the
table; so the first row shows that all 15 firms doing
formal costing calculate the total costs of the function
yearly, whilst the final row shows that only three of these
firms calulate costs on an individual vehicle basis,
weekly.

The variety of approaches used is evident. Some firms
calculated per vehicle costs (i.e. the costs for each
vehicle for each period were calculated using actual cost
figures collected internally). Some, however, only
calculated costs for each category of vehicle (i.e tippers,

crane lorries, articulated vehicles, etc.). Others

calculated costs per weight category of vehicle (i.e. the

costs for all 24 tonners together). Still others only

calculated very general costs for the fleet as a whole

without disaggregating them. Again, the O/A firms

calculated costs in much less detail than the H/R firms.

Fewer O/A firms calculated individual vehicle running costs

and only one calculated per vehicle standing costs.

A similar level of difference was found in the methods of

allocating fixed costs between vehicles, as shown in fig

5.1 (d). Some divided them equally between vehicles whilst

others divided them on a usage or some other basis.

In many of the O/A firms, transport was not viewed as an

integral part of the production process, but rather as a

necessary addition to it. Little attention was paid to the

transport aspect and even less was paid to the efficiency

of the transport; although there was some evidence to show

that this was slowly changing. The principal objective was

to get the goods to the customer on time and in good

condition. The success of the transport department was

often gauged in terms of the number of customer complaints

received rather than on costs.

The differences in degree of detail of the costing systems

used may, to some extent, be due to variations in

operators' reasons for doing costings in the first place.

These are shown in Table 5.3

TABLE 5.3

REASONS FOR COSTING

FIRM	Reasons for costing and opinions of costing system
Hire or reward	
1	There are different attitudes to costing in different parts of the company. Head office demands that costings are done although the particular branch visited does not use the information available except to keep an eye on the overall costs of the operation. The depot manager thought that the information obtained was too detailed. He would prefer to make the depot as a whole profitable rather than each division within the depot. Costing each division made internal competition too stiff and employees worked towards profitability of the division at the expense of depot profitability and efficiency.
2	This company was previously in very bad financial trouble and had reduced their fleet tremendously as a result. They therefore felt it necessary to scrutinise costs to ensure that the same thing did not re-occur. They continuously conduct experiments to find the most efficient way to operate and are especially concerned with keeping costs constant and forecastable. They appeared to be quite pleased with the costing system.
3	The managers do costings to know exactly how well the company is doing. They felt this was necessary with such a large firm, for otherwise there was no way of monitoring performance. Much thought goes into making the system work and keeping good records. The manager believed it worked well.
5	This firm did costings to aid rate setting. The manager felt it necessary to know the running costs of his fleet to give him an idea of his minimum rate. He felt it was easier to ask for rate increases if he could show he knew what his costs were. He also liked to know how the firm was doing.
7	Costings were done to monitor performance. As the manager was not very technically minded he liked to make up for the inadequacies in this area by being extra careful on the costing side. Costs were not used for setting rates much to the raters dismay. The manager believed the costing system to be simple but effective.
9	Costings were done to monitor performance. It is all carried out on computer; the system is very flexible and the managers are very pleased with it.

TABLE 5.3 - CONTINUED

FIRM	Reasons for costing and opinions of costing systems

Own account

10	Running costs calculated as a monitoring exercise to ensure that vehicles performing exceptionally well/poorly would become apparent. They were kept also so that could be used in the course of planning. The transport manager was not keen on costing, he believes the practical problems and the wide variation of circumstances in transport meant that costing was of less use to him than a good communication line between the drivers and himself. Transport was a service to production side and it was this service that was of paramount importance irrespective of its cost. Transport not a profit centre although the garage is.
13	Costing done for monitoring purposes principally, but also for planning and analysis purposes. Costing not regarded as that important and only per period costings are done. Running costs are seen as the most important element of costs because they are most controllable; standing costs are of little interest to the management and only a total standing cost for the entire fleet is obtained by the management. Transport is not a profit centre.
14	Costing is really only done thoroughly on the leasing element of costs. This is because leasing is done on a mileage basis and accounts for such a high proportion of total transport costs. (The lease includes maintenance tyres and oil). Costs are done for monitoring purposes. Transport manager believes the costing system is adequate. He does not do per vehicle fuel figures because the lorries are refrigerated and it is difficult to tell whether the fuel is being used by the fridge or by the vehicle. Again, transport is regarded primarily as a service, so costs are not seen as being of paramount importance. Transport not a profit centre.
15	Again, costs are done to monitor the performance of the vehicles. Running costs seen as the only controllable items and therefore the items of direct interest. Interdepot cost comparisons were valued as being of some importance in the company to try to give managers an incentive to reduce costs, as were the intercompany comparisons. The transport manager at the depot however was not too enthusiastic about costings because he believed there were always reasons why there were anomalies and inaccuracies. Transport is cost centre.
16	Only the very general monthly costs are done because transport is viewed as a service to production and is required at any expense. The transport manager believed it would be practically impossible to do detailed costings because so many unusual factors were involved in the operation, i.e. no regular trips were made. The monthly costs were kept so that actual cost figures could be compared against budgeted costs. Not cost centre.
17	Costs done to monitor vehicle performance. Not really interested in fixed costs because these were uncontrollable. Transport manager was not interested in per vehicle costs specifically, more in distribution costs as a whole. He liked to compare distribution costs per ton with those of other depots to see how the depot was faring. Not cost centre.
18	Costs were monitored very strictly as a control mechanism. Without such costings they could easily get out of hand, it being such a large organisation. Both detailed and succinct costings were done so that no matter what purpose costings were desired, they would be available in the required format. It was felt that this was necessary if all strata of management were going to use them to their full advantage.

135

Operators gave a variety of reasons for doing costings, the most common one was that it was necessary for performance monitoring. The perceived level of detail of costing necessary for effective performance monitoring, however, differed between transport managers. Some believed it necessary to monitor per vehicle costs, while others were content to monitor total transport costs.

Some of the H/R operators used costings to support haulage rate increases, so that if customers questioned the rate increases, they would at least have some justification for them. It also helped to give the impression of a well run, efficient business. This, they felt, was necessary because of the stereotype image of haulage companies as badly run 'cowboy outfits'.

Performance monitoring was also necessary for the O/A operators because it was the only method of comparing performance with budgets. In every case, the transport department was a cost centre and in one case it was a profit centre. The transport departments worked within budgets set in conjunction with higher management. Annual budgets were the most common; these were often simply divided into twelve monthly budgets with no account taken of the neccesary monthly fluctuations in expenditure. If expenditure was within the budgeted amount, the former was increased, because the penalty for underspending was a reduction in the following year's budget.

Budgets were often not calculated from scratch each year;
some firms merely updated the previous year's budget by
adding a certain percentage to it according to crude
estimates of changes in conditions and requirements.

5.3.2. Rate Setting (Hire or Reward only)

All of the firms visited did a mixture of spot-work (i.e.
work for non regular customers) and contract work (i.e.
work for regular customers). Pricing methods differed
slightly between the two.

For both spot and contract work, most firms used a
tonne-mileage based rate schedule for pricing. The
schedule rates were calculated using a loose
average-cost-plus-markup method. However, rather than
using exact mileages, the schedules were based on mileage
zones. Zones varied in size between firms, from 25 miles
radius from base to a third of the entire country.
Similarly, there was not a separate rate for each tonne
carried. Divisions were used so that, for example, any
load of less than 5 tonnes would be taken for one rate and
a load between 5 and 10 tonnes would be taken for another.
Tonnage divisions ranged between 1 and 5 tonnes. Over a
certain tonnage, the load was treated as a full load, and
full load rates were charged.

The rate schedules used were often very dated. Although
originally cost based, they had been updated at various
intervals using a percentage based on judgement of cost
increases and of what the market would bear. Some years,
this had meant no cost increases at all. Thus, over time,
schedules had become progressively inaccurate. The same
was true of contract rate schedules.

When quoting spot rates, the rate-setters often preferred
to use judgement and experience of rates rather than the
rate schedules. In this way, rates could be more easily
related to customer variables such as urgency, value of
cargo etc. and the circumstances of their own firm at the
time.

One of the main contributions of costs to rates in spot
work was to set a minimum rate below which hauliers were
loathe to work. This was frequently only a very
approximate figure, used. to cover any vehicle over, say, 24
tonnes GVW. Even this minimum rate was flexible. Most
hauliers were prepared to accept a lower rate for a short
period of time and even to incur a loss on some journeys.

All of the hauliers had contracts of long duration with at
least one customer as well as doing spot work. The
duration of the long term contracts varied between firms,
but many had lasted over 20 years. Some firms had grown up
around the business of one customer who still provided a

high proportion of their work. Rate contracts with these customers were usually reviewed annually and included clauses to the effect that should there be major cost increases (e.g. on fuel), haulage rates would also be subject to increases. Most hauliers were loathe to increase rates frequently through fear of losing the customer, so many of the cost increases were just absorbed.

In all but one of the H/R firms, the quoted rate covered the outward journey only. It was their responsibility to find a backload to cover the return trip. The pricing of backloads and the whole backload policy followed similar patterns in all of the firms. It was a case of "getting what you can, for anything is better than nothing". Whether the bacload rate was economically viable was only calculated in very general terms. Little attention was paid to the time it took the driver to find the backload location and to load and unload. The additional mileage incurred was also calculated with little precision.

5.3.3 Related Aspects

Use of Published Costs Tables

Chapter 2 showed that published tables of operating costs were used by academics and policy makers for enumerating the costs of road freight transport. They believed them to be an accurate representation of transport

139

providers costs and, consequently, a determinant in their decisions. Table 5.4 shows the extent to which transport providers used published cost tables and their opinions of them.

All but one of the firms in the study received copies of at least one set of published cost tables. Motor Transport tables were the most popular. Commercial Motor tables found greater popularity with O/A operators than with H/R operators. However, despite the very high receipt rate, they were only used by one H/R and one O/A operator for the purpose of costing or rate setting. The H/R exception used them only to quote rates to first time customers when he was too busy to calculate a more realistic rate. The O/A operator used them because it was a condition of membership of his particular trade association. Most of the operators, in fact, had a very low opinion of them.

Transport providers seemed, in the main, to be aware of many of the problems associated with the tables and were especially suspicious of the fact that they were uninformed of their methods of compilation. Their main purpose was to provide a comparison with firm's own costs. Firms regarded the published costs as unrealistically high. They therefore acted as a benchmark; if firms own costs rose above those in the tables, then something was wrong.

Information in the tables was also used for surveillance purposes. Managers liked to read all the information

TABLE 5.4

EXTENT OF USE OF PUBLISHED COST TABLES BY TRANSPORT PROVIDERS IN THE SAMPLE

FIRM	Cost tables received	Used for costing/pricing (Y/N)	Use put to	Opinions of tables
Hire or reward				
1	CM, MT	N	Use them to compare with own rates out of interest	Not much use for costing or pricing. The published rates are always too high.
2	CM, MT	N	Likes to compare them with own costs. Shows them to customers to demonstrate how low own rates are.	Not much use for costing. Unreliable. Always too high.
3	MT, RHA	N	Occasionally uses them for comparisons and to justify own rates to clients.	Only has MT because they are free with the paper. Does not like CM because based too much on mileage.
4	RHA, MT	N (except uses RHA wage rates for drivers)	None except the occasional inquisitive comparison against own rates.	Both too general and do not fit own firm's circumstances. Overheads in tables too high. Costs based on different mileage than own vehicles and has no inclination to adopt them.
5	RHA, MT	N	Comparisons with own rates. Took own cost framework from RHA.	Used to rely on RHA for costings but realised that it was better to do their own because circumstances differ so much. Get RHA tables only because they are free now.
6	RHA, MT	N	Uses them to refer to occasionally. Used to use MT framework about 8 years ago before giving up costing. Uses them to justify rate increases.	Prefers RHA tables because they are regionally based and therefore should be more accurate. Both are too high.
7	RHA	N	Comparisons with own rates.	Believes RHA tables are dubious and CM and MT are hopeless.
3	RHA	Y	Rate setting for new one off customers.	Uses them because it easy to do so and because it sounds professional.
9	MT, CM	N	Comparison with own costs.	Very unrealistic.

TABLE 5.4 - CONTINUED

FIRM	Cost tables received	Used for costing/pricing (Y/N)	Use put to	Opinions of tables
Own account				
10	CM, MT	N	Transport manager does not even look at them, but distribution manager uses them for comparisons.	Believes they are inaccurate.
11	MT	N	Uses them to get an idea of market rates. Believes they are an accurate representation of other people's actual costs.	Thinks that some items are quite good but overall are no good for the particular geographical area.
12	MT, RHA, DSF*	Y	Uses RHA and Devon Stone Federation* for pricing transport element of total price.	Has no faith in CM and MT tables because everyone's costs vary. DSF and RHM tables used because it is agreed in the trade and it makes things easy. Believes DSF and RHA not very accurate.
13	MT, FTA	N	Used as comparison with own rates and to get idea of "commercial rates".	Believes they are made for a different kind of operation than theirs.
14	CM, MT, FTA	N	Used to comparison with own rates and to get an idea of market rates. Hires H/R transport occasionally and believes can give an idea of the hire or reward rates. Personnel dept. uses them to keep transport manager on his feet.	No specific opinion expressed.
15	FTA, CM, MT UKASTA	N	Send their costs to UKASTA who analyse them in their framework and also send a copy of other members in the group's costs in the same framework. Also distribution manager at head office enters own costs into FTA computer and gets breakdown in their too. At depot visited the transport manager compares depot costs with other depots but not very often.	Believes UKASTA and FTA tables are better than MT and CM as they are more suited to their own operation. Head Office thinks the comparisons are worthwhile and the tables are useful.
16	MT, CM	N	Used them to justify transport costs to managers higher in the hierarchy. Used as comparison.	Believes they are useless. Get them out of curiosity.

TABLE 5.4 - CONTINUED

FIRM	Cost tables received	Used for costing/pricing (Y/N)	Use put to	Opinions of tables
Own account		14 3		
17	None	-		Has little use for them. Not interested in other peoples' costs.
18	MT, CM, FTA, RHA, DSF	N	Used as comparisons with own costs. Like to have them to refer to even though they have little faith in them.	Does not like them because do not know what they are based on. Also they are at times difficult to interpret. However, since they are published and are on a subject of direct relevance to them, they should be looked at.

available on their subject - even if it was unreliable -
just to keep up to date. Some of the O/A operators used
the tables to gauge the market for outside haulage rates
despite their recognition that the tables were an
inaccurate representation of their own costs. They
believed that although the tables were unsuitable for their
particular type of operation, they were probably suited to
other types of operation, and that other transport
providers would, therefore, use them. The other main use
to which the tables were put was to demonstrate to others
how low their own costs were. They were used in this way
by transport managers who sometimes showed them both to
higher management to prove their own efficiency and to
customers to illustrate their firm's competitiveness.

   Methods used to obtain work

 H/R operators' methods of obtaining outward loads was very
similar to their method of obtaining backloads. They
relied to a large extent on receiving telephone calls from
transport users with work for the following day. Some had
regular contracts with their major customers - which were
given priority. Usually all the work offered was accepted,
and when the vehicles were full, the search for work was
stopped. If too much work was received, the most
profitable jobs were kept and the others subcontracted
(unless these happened to be with regular customers).

 Very few H/R operators did much marketing. Most waited

for work to come to them rather than trying to increase it through their own efforts. Promotional activities were limited to having their own livery, well presented vehicles and advertisements in the 'Yellow Pages'. The only other promotional aspect was their membership of the FTA and RHA which, they believed, gave them an air of professionalism.

 Use of Computers and Tachographs

 All but three of the firms had a business computer on which costing could have been carried out. Only three, however, used them for this purpose. Several others calculated fuel, wages and maintenance costs on computer in isolation. Their use was mostly confined to administrative and clerical work such as payroll and invoicing. They were used to reduce the drudgery of clerical work rather than to improve operational efficiency.

 Where firms had changed to computerised data collection the changeover had entailed little alteration to the prevailing methods. Often the computer did exactly the same as what was previously done manually; the greater capabilities of the computer were neglected. In some cases, because of their mistrust of the computer, manual records were still kept. Thus the whole data collection process was being duplicated.

 Two of firms had invested a great deal of effort and money

in establishing a good computerised costing system. The
output produced, however, was so great that it was rarely
consulted. A few particularly relevant pages were glanced
at but the majority was completely redundant. Although
several firms employed data inputers, none employed data
analysts.

The potential of the tachograph was similarly
underutilised. Although all the HGVs had a tachograph, the
information obtainable from them was rarely used. Many
operators checked them quickly for legal offences and then
stored them away in case of a visit from the Department
of Transport inspectors. Some operators had purchased an
electronic tachograph analyser and others sent their charts
away for computer analysis, but still, in both cases,
little was done with the information produced. Even when
legal problems or obvious driver negligences were
identified, little was done about it for fear of ruining
good driver - management relations.

Vehicle Replacement

Few of the firms gave a great deal of attention to vehicle
replacement analysis. Experience and tradition was often
used rather than an analysis of the relative merits of
replacement versus repair. Many firms appeared not to have
altered their replacement policy for years. Many had
effectively cut out a large proportion of the vehicle
market by their policy of 'buying British'. Some had

146

recently abandoned this policy because of the perceived superiority of foreign makes, but the impression given is that they would not have done so had the advantages not been huge.

5.4. Discussion. Relating the Results to Behavioural Theory

In the following text, where it is not explicitly stated, an asterix (*) denotes a point of direct support for the behavioural theory.

5.4.1. Costing

The results above showed that there was a considerable degree of difference between firms in their approaches and attitudes to costing and pricing. In some firms, very detailed costings were done and a great deal of importance was attached to them, while in others, no costings were done at all. Most managers regarded their costing systems as completely adequate for their purposes and many suggested that they were minimising costs; although because of the monitoring systems used, there was no way of doing this. This is consistent with behavioural theory which suggests that each firm would have a different approach to costing and pricing. An approach that was rational to one manager would not necessarily be rational to another. Rationality depends on an individual's definition of the

situation and his goals.

Five of the firms did no costings at all. They were, nevertheless, acting intendedly rationally(*). All five firms were owner-managed. Costing was viewed by the owner-managers as an unnecessary and somewhat irrelevant task. Their main goal was not profit maximisation but enjoyment of their work subject to the achievement of an acceptable level of profits(*). Partly because of their training and background, (i.e. many of them had previously been drivers) their approach to making an acceptable level of profits was to give priority to the service provided. Their attitude seemed to be one of 'as long as there is enough work to do, the costs will take care of themselves.'

Of the firms that did costings, the H/R operators tended to calculate them in considerably more depth than the O/A operators. This can again be explained in terms of goals and again supports the behavioural theory. In all of the O/A firms, transport was a separate department with a separate budget (i.e. it was a specialised subunit)(*). The transport department had to compete with other departments in the organisation for resources. The principal criterion on which performance was judged was service provided to the customers. This was measured in terms of speed of delivery and number of customer complaints received. Thus, service took priority over cost minimisation. Because specialisation occurred, little interest was expressed in detailed transport cost figures,

outside of the transport department(*). It was only necessary, therefore, to do general costings. All that was required of the transport department was that they remained within their budget (*).

Thus as behavioural theory suggests, specialisation into subunits occurred so that organisational members' knowledge was confined to one particular aspect of the business. This led to subunit conflict which was partly resolved through the use of budgets.

In each firm, one individual was responsible for collation of cost data from the various parts of the organisation for insertion into the cost framework. The whole cost data collection process was governed by a series of standard operating procedures, (SOPs), and, in most cases, was completely routinised (*). Fuel consumption, for instance, was typically recorded using a computerised pump which noted the quantity of fuel used at any one time by any one vehicle. The individual responsible for data collation would take the details from the computer output and enter them into a fuel consumption record book. Reliance on this SOP was so strong that when the computer device broke down, fuel usage went unrecorded. Although alternative arrangements were made, for example, that drivers should enter the quantity used in a book at each visit to a pump, because this was outside their normal routine, it was often neglected(*).

Collection of data on other costs was similarly
routinised. Little thought seemed to be put into
consideration of the other possible methods of data
collection; once an SOP was established, it was rarely
changed(*). The cost frameworks used were themselves very
infrequently adapted once set up. Even where firms had
changed to computerised costing systems, this had entailed
little change to existing SOPs; the whole system was not
reappraised to take advantage of the increased power of the
computer - the manual systems were merely computerised.
Thus change was very incremental(*).

Often a great deal of information on vehicles was
recorded, but costs, which could easily have been
abstracted from the data, were ignored. For example, most
firms kept files on the maintenance carried out on each
vehicle in their fleet. With a little additional effort,
this could have been translated into per vehicle
maintenance cost data. Because no SOP existed, nothing was
done about it. Information that was not covered by an
existing SOP was ignored(*).

In nearly every case, historic costs were used in the
calculation of depreciation. The cumulative depreciation
of a vehicle should not just cover the price of that
particular vehicle, but the price of a similar replacement
vehicle. Because of the reliance on SOPs, however, few
companies had converted to current cost accounting. It
would have taken an unprogrammed decision to build this

into the cost framework; consequently, it was not done. Day to day activities took precedence and continued in spite of the fact that individuals recognised the problems(*).

The extent of the reliance on SOPs can be further illustrated with reference to computers. In several firms, an individual had been given the responsibility of inputing cost data (or at least physical data that could quite easily have been translated into cost data), into a computer. However nobody had similar responsibility for analysing the output. The information output was merely contributing to information overload(*). Yet managers were continuously demanding more information(*).

The cumulative effect of the reliance on these SOPs established in the past under a different set of conditions, was a great deal of satisficing(*). Organisational members did not work as efficiently as possible because they were stuck in routines which were designed to facilitate operational activities, but which were slightly outdated(*).

Behavioural theory stresses the importance of budgets and targets as control mechanisms and precedents for behaviour. In each of the O/A firms, transport expenditure was controlled by budgets set in conjunction with higher management. The express aim of the budget was to keep expenditure at an acceptable level. However, as

behavioural theory suggests, it did not necessarily have the desired effect. If expenditure looked like it would exceed the budget, this acted as a signal to managers to discover why. If the department was underspending in relation to budget, then spending was increased. The penalty for underspending was a reduction in the following year's budget. The budgeted amount was, therefore, used irrespective of the necessity for the expenditure. In some cases, it acted as a disincentive to innovation. Transport managers believed, for instance, that it was not worth saving money by introducing new vehicle schedules because not only might it affect their good relationships with the drivers, but it would only result in a decreased budget allocation for the following year.

A substantial degree of satisficing existed in the setting of budgets(*). Ideally, in each period the needs of each department in the firm should be appraised from base and the appropriate resources allocated. However, in practice it appeared that each department was given a certain percentage increase over the previous year; the actual percentage dependent not on the relative requirements of the departments, but on the bargaining strengths of the respective managers(*). Again, because of subunit specialisation, actual cost figures were not used in the bargaining process, but biased, selective information(*).

Transport departments in the larger O/A firms had their

performance compared against other depots in the company.
The purpose of this was again to act as a control mechanism
and to provide incentives to reduce costs. In actuality,
it appeared to have the same effect as the budgets;
managers sought to stay in the middle range in the
comparisons rather than seeking to be the best in the
company. A position near the bottom of the range was
regarded as job threatening by the transport manager and so
costs were considered carefully. A position near the top,
however, was similarly undesired because once at this
position, there was pressure to remain there and questions
asked if they did not. Intendedly rational control
mechanisms introduced to minimise costs, therefore,
appeared not to have the desired effect and again
contributed to a substantial amount of satisficing(*).

5.4.2.Pricing

As behavioural theory suggests, rate setting was done on a
subjectively rational percentage markup-on-average-costs
basis. The magnitude of the markup depended on various
factors such as the perceived level of competition, the
firm's own need for work, etc. The use of rate schedules
(SOPs used to simplify and standardise rates across rate
quoters), routinised the whole process(*).

Many examples of satisficing were apparent throughout the
rate setting and related areas(*). The rate schedules were

zonal based and were divided into tonnage divisions for the
convenience of both the customer and the rate setter.
Rates could not, therefore, be directly related to costs.
The schedules were also often dated. The same schedule was
used for many years, updated every year by a percentage
based on judgement. This appeared rational to the rate
setters. Again, the process had become so routinised that
operators could not see the consequences of their actions
objectively. Hauliers also had a tendency to quote rates
similar to those on other contracts rather than calculating
them directly from costs. Rates were also dependent on the
particular individual quoting.

 Even in the case of the long term contracts, there were
many examples of satisficing. The gaining of long term
contracts can be viewed as a method of uncertainty
reduction(*) as it increases the quantity and regularity of
work. Hauliers' recognition of the advantages of obtaining
long term contracts was witnessed by the fact that most
hauliers had a great deal of capital equipment tied
exclusively to one customer. Rates for these contracts,
however, were only reviewed annually and again only updated
by the addition of a certain percentage based on judgement
of cost increases. As long as the rate was satisfactory,
nothing was done to change the situation.

 Obtaining and pricing backloads was another area of
satisficing. To obtain a backload, the standard procedure

was to telephone a list of manufacturers or other hauliers built up over the years, starting with those closest to the outward delivery point and getting progressively closer to base until a load was found. Once a load had been found, the search process was terminated; it was not continued until the best offer had been received(*). The rate received for the job was arrived at through a process of bargaining. Little analysis was done to ascertain whether the rate even covered marginal costs.

Subcontracting rates were also set by rules of thumb(*). Usually a certain percentage was deducted from the rate at which the work was originally offered. The work was then passed on to other known hauliers. The use of known hauliers was another method of creating a negotiated environment(*). Only reputable hauliers were given subcontracting work. This reduces the possibility of the haulier doing the work reneging on his responsibility, and therefore, reduces the chances of the transport user offering the work to another haulier in the future.

Feedback was important in both spot rate and contract rate quoting(*). Feedback was obtained from reading trade magazines, from talking to drivers and through subcontracting. It was taken into account in the subjective markup percentage.

5.4.3. Related Aspects

Published Cost Tables

The non use of published tables of operating costs also
supports many of the hypotheses of behavioural theory.
Transport providers seemed, in the main, to be aware of
many of the problems associated with the use of such
tables. It could be argued that satisficing operators
would use these formalised sources of cost information for
such purposes as costing and rate setting. This is not
necessarily so. Certain satisfactory targets need to be
met before a satisficer would use the tables.   It seems
likely that the tables did not meet these targets. Costers
comments in Table 5.4 appeared to bear this out. The cost
tables instead, formed a rule of thumb process triggering
search(*). If costs were higher than those in the tables,
then search is triggered to discover why.

The information in the tables was also used for
surveillance purposes(*). Managers liked to read all the
information on the subject to keep up to date. The fact
that they showed them to managers and customers illustrates
their desire to give a semblance of rationality(*). It
also substantiates the hypothesis that subunitisation
occurs. Neither higher management nor customers have a
great deal of knowledge of the true costs of transport.
They are forced to rely on information from their
'specialists'. Information received by higher management
is, therefore, biased(*).

5.5. Summary and Model

This chapter has shown that costing and pricing behaviour in the 18 firms surveyed conforms quite closely with the description given in the literature on behavioural theory. It has been demonstrated, for instance, that members satisficed rather than maximised, were intendedly rational, tried to reduce uncertainty by creating a negotiated environment and were adaptive organisms relying to a large extent on standard operating procedures and rules of thumb. Costs and prices were not controlled by one individual seeking to maximise profits, but depended on the interaction of many individuals each with different goals. Members had different methods of operating depending on their aspirations. There were no industry wide methods of costing and pricing but a range of methods ranging from the very proficient to the almost non existent, each one equally acceptable to the transport managers of the individual firms using them.

The objectives of this thesis include to discover how perceived costs and prices are determined and to investigate the influences on costing behaviour. Since support for the behavioural theory is so strong on a general level, it is logical to assume that it could provide some insights into both the determination of costs and the influences on costing and pricing behaviour. It is proposed that several variables emerge from the behavioural theory and the on-site observations which could have a

157

determining influence.   This chapter concludes by proposing
the following model of perceived cost determination.

FIGURE 5.2

MODEL OF THE DETERMINATION OF PERCEIVED COSTS
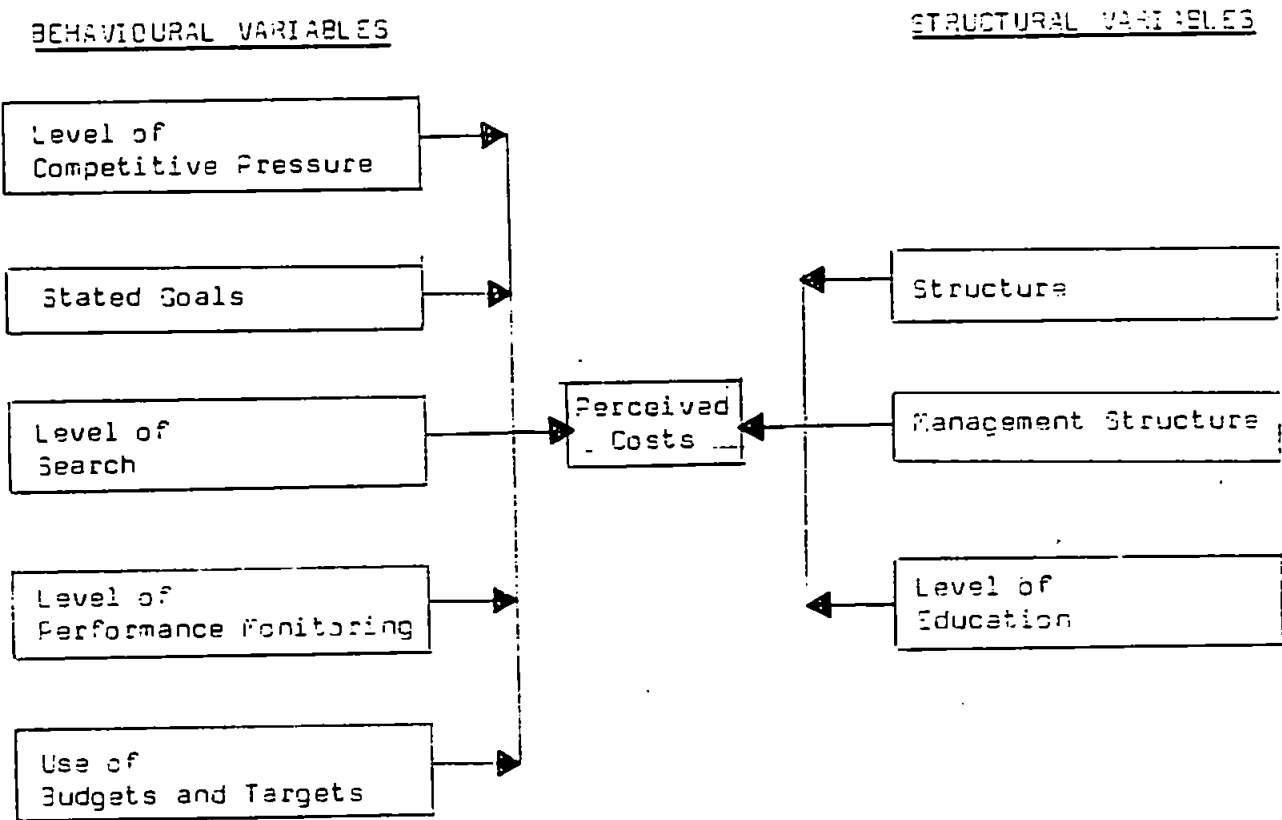
BEHAVIOURAL VARIABLES   STRUCTURAL VARIABLES

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┌─────────────────────┐
│ Level of            │────▶
│ Competitive Pressure│
└─────────────────────┘

┌─────────────────────┐                        ┌─────────────────────────┐
│ Stated Goals        │────▶         ◀─────────│ Structure               │
└─────────────────────┘                        └─────────────────────────┘

┌─────────────────────┐        ┌──────────┐    ┌─────────────────────────┐
│ Level of            │───────▶│ Perceived│◀───│ Management Structure    │
│ Search              │        │  Costs   │    └─────────────────────────┘
└─────────────────────┘        └──────────┘

┌─────────────────────┐                        ┌─────────────────────────┐
│ Level of            │────▶         ◀─────────│ Level of                │
│ Performance Monitoring│                      │ Education               │
└─────────────────────┘                        └─────────────────────────┘

┌─────────────────────┐
│ Use of              │────▶
│ Budgets and Targets │
└─────────────────────┘
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158

PRELIMINARY TESTING OF THE MODEL RELATING BEHAVIOURAL
THEORY TO COSTS AND PRICES.   RESULTS FROM A SURVEY OF
THE SAME 18 FIRMS.

6.1 Introduction

The previous chapter demonstrated that there was
considerable empirical evidence to support the
applicability of behavioural theory to transport operators'
costing and pricing methods and approaches. It ended by
proposing a model of the determination of perceived costs
and the influences on the level of detail of costing in
terms of a set of structural and behavioural variables.
The purpose of the present chapter is to discover whether
there is any preliminary support for this model. It builds
upon the preceding chapter by considering costs and rates
obtained from the same 18 firms by way of a
quasi-experimental design in costing and pricing (QEDCP),
and relates them to the stuctural and behavioural
variables, data on which was obtained using a
questionnaire, also sent to the 18 firms.

Although approaches to cost and rate setting were
considered in some detail in the on site visits, figures on
perceived costs and rates were not actually obtained.
Also, the information obtained from the on-site visits was

very unstructured, making inter-firm comparisons difficult.
Asking the operators to complete a questionnaire was a
method of formalising the data so as to facilitate
inter-firm comparisons and the linking of the variables to
perceived costs. It provides, therefore, a link between
the in-depth study of the approaches to costing and
pricing (the subject of the previous chapter) and the
statistical determination of costs; one of the ultimate
aims of this thesis and the subject of the following
chapter. It also acts as a kind of pilot study to the large
scale survey, by indicating the best method of obtaining
the required information in terms of the kind of questions
it would be appropriate to ask and even the exact form of
the questions.

The chapter starts by describing and rationalising the
research method. It goes on to analyse the responses to
the QEDCP and questionnaire, first independently, and then
in relation to one another. It is shown that the
structural and behavioural variables have a considerable
influence on costs and concludes that a full scale survey
is necessary to determine the precise relationships.

6.2.   Research Method

6.2.1. Collection of data on costs and rates.

Observations at the 18 firms showed that costs and rates

at any one firm varied according to factors such as the
urgency of the load or familiarity with the customer. In
order to discover and understand the relationship between
costs and rates and the behavioural and structural
variables, therefore, a method of eliciting costs and rates
for a variety of conditions was necessary.

The method used had to be simple, for although the
operators had pledged further help, many were somewhat
apprehensive of the value of academic studies. They would
not, therefore, spend a great deal of time trying to
understand the format of the exercise.

The research instrument used for eliciting costs and
rates took the novel form of a quasi-experimental design in
costing and pricing (QEDCP). A QED is described by Cozby
(1981) as "an attempt to approximate the control features
of true experiments in order to infer that a given
treatment did have the desired effect". Yin (1984) says it
may be used "in situations in which the experimenter cannot
manipulate behaviour but in which the logic of experimental
design may still be used."

The QEDCP had to incorporate two essential features:
1) it had to be standard so the inter-company
comparisons could be made.
2) it had to be relevant to all the operators.

Designing a single QEDCP with both these properties proved

to be impossible. The 18 firms had a variety of vehicle types (tippers, artics, etc.), operated using different financial systems (some were cost centres, some profit centres) and had a wide range of activities. A division was, therefore, made between O/A and H/R as this was the most obvious differentiating factor. The final versions of the QEDCP are shown in Appendix 4a.

Because of the originality of this approach, the QEDCPs are described in some detail below.

The QEDCP.

The operators were presented with a "job opportunity" based on a certain set of conditions (see below), which they were asked to cost and price. In turn, each of the conditions was changed and the operators were asked to give a new cost and price taking into account these changes in conditions. Thus, the exercise attempted to be a realistic simulation of the work normally carried out by those responsible for costing and pricing within the firms. It was quasi-experimental in that each question introduced one change to the original "job opportunity" for which costs and rates were sought, whilst all other conditions remained the same.

Job Opportunity (H/R)

"It is Tuesday and your firm is in a relatively slack period. A new customer asks you to transport 3 loads of palleted tinned peas (retail value £500 per tonne) weighing 10 tonnes, 20 tonnes and 23 tonnes to Newcastle Upon Tyne for delivery on Friday. You know backloads will be available from Newcastle to your depot for which you will receive £250 per vehicle. (You may assume that the loads would fit into curtainsiders if desired)".

Points Arising

a) Tuesday was stipulated to give an idea of the urgency of the load.

b) A slack period was suggested to give an indication of the workload at the time.

c) Tinned peas were chosen as this was a very standard load of average value, with no special requirements such as additional insurance, and no handling problems such as fragility.

d) The three weight categories were chosen as they represented a full load for a 32 tonne vehicle (20 tonnes), a full load for a 38 tonne vehicle (23 tonnes) and an approximately half load for either of those vehicles. The 32 tonne and 38 tonne vehicles would be weight constrained with these loads. The weights specified would enable comparisons of the costs and rates of a 32 tonne and a 38

tonne vehicle.

e) Newcastle Upon Tyne was selected as the load destination point as it is a large, well known city, far enough from each of the firms to involve a considerable level of trunking. A specific destination rather than a distance was stipulated as the operators would then know the sort of route this would involve and thus the likely journey time.

f) A backload rate was specified to make the job opportunity realistic. The actual rate was suggested by the operator used in the pilot exercise (see below).

g) At the suggestion of this haulier, a sentence was included at the end to the effect that the loads would fit into a curtainsider. This was purely for clarification purposes.

h) The specification of a new customer signified that spot rates should be quoted.

Subsequent Questions

Following the job opportunity, the person(s) responsible for costing and pricing in each firm was asked to answer 12 questions. The rationale for question 1 will be described below. As the subsequent questions follow the format of

this first question, only the changes will be described.

Question 1

a) How much would it cost you to transport each load to its destination assuming you could find no other goods to send along with the 10 tonne load?

b) What type (e.g. artic 3+2) and maximum GVW of vehicle would you use for each load (please state if not a vehicle in your fleet)?

c) What price would you charge for each load assuming you allow no discount for transporting these loads?

d) Would you prefer to subcontract these loads?

Comments

Part a) asked the respondent to assume that no other goods were sent along with the 10 tonne load to indicate that this load must be taken by itself

Part b) was designed to show whether a 32 tonne or a 38 tonne vehicle would be used so that costs and rates could be related to GVW.

Part c) sought to determine whether the job opportunity was within the operators'save chap6b normal realms of work.

The remainder of the questions asked for the same

information given a change in one of the conditions of the job opportunity. The rationale for the changes is as follows:

Question 2 asked the respondent to assume that instead of peas, the cargo was (i) costly precision goods (retail value £1500 per tonne) and (ii) cheap newsprint (retail value £100 per tonne). This question sought to ascertain the influence of the cargo's value on the price charged. Precision tools and newsprint were specified because they were both examples of heavy products which would weight constrain the vehicles.

Question 3 increased the urgency of the loads by stipulating delivery on Wednesday and stating that they would only be ready for collection at 4p.m on Tuesday.

Question 4 sought to discover the influence of availability of work by asking the respondent to assume that their company was busy rather than being in a slack period.

Question 5 asked the respondent to take one load of 20 tonnes a) 100 miles b) 400 miles and c) 450 miles, rather than taking three loads to Newcastle. The purpose of this question was to discover the influence of distance on price and cost.

Question 6 asked the respondent to assume that the job

166

was for a regular customer who accounted for 35% of business. It sought to gauge the influence on price of regularity of custom.

In question 7, the respondent was asked to assume that no backloads were available. Thus it sought to determine the difference made to rates by the absence of backloads.

Question 8 introduced heavy traffic conditions which slowed the journey by 2 hours. The response given to this question was designed to show the effect of actual as opposed to expected changes of journey time on rates.

Question 9 concerned the issue of volume constrained as opposed to weight constrained loads and asked the respondent to assume that the loads were bulky toilet rolls.

Question 10 asked the respondent to give an estimate of the fair price for the job. Hauliers constantly complained of rates being too low to make any profit. The purpose of this question was to see how close actual rates were to desired rates.

Finally, question 12 sought to discover whether hauliers believed they had the most efficient vehicle for the job and if not, what vehicles they would have liked and the difference this would have made to the cost and prices quoted before.

A draft version of both the QEDCP and the Questionnaire
(see below) was taken to the most helpful operator on the
initial visits. He was asked to complete the exercise and
to say what he understood to be the meaning of each
question. Belson (1982) has shown the importance of asking
what respondents understand to be the meaning of questions
and not merely whether they understand them.

Own Account QEDCP

Standardisation of the H/R QEDCP was relatively simple
because H/R firms normally carry a variety of goods and
would, therefore, be able to envisage carrying a standard
product, such as peas, to any location specified by a
customer. This is not the case for O/A operators. Most
carried solely their own products to fairly fixed
locations. Their operations were much more rigid. To deal
with this problem the O/A questionnaire was made specific
to the operators' own products.

Since the rationale behind the QEDCP was the same as that
for the H/R QEDCP, and some of the questions were the same
(except insofar as the product they are asked to carry was
different), description of the O/A QEDCP will be kept to a
minimum. The complete QEDCP is shown in appendix 3a.

Job Opportunity

"It is Tuesday and your firm is in a relatively slack period. A new customer asks you to transport three loads of .... weighing 10 tonnes, 20 tonnes and 23 tonnes to Newcastle Upon Tyne for delivery on Friday. You know that it will be impossible to obtain backloads."

Space was thus left for the insertion by the researcher of the product manufactured by the company. For example, where the product was beer, "packaged beer" was inserted. It was stated that no backloads would be obtainable as some of the firms visited could not carry backloads because, for instance, they had empty barrels to return.

The main differences from the H/R QEDCP were:
1) the questions varying the value and bulk of the load were omitted because of their irrelevance to O/A operators.
2) the question concerning regularity of custom was changed to one which asked them to assume that the customer accounted for a large proportion of the market for their product.
3) In the H/R QEDCP, one of the variations was to assume that no backloads were available. In the O/A simulation, the variation was to assume that backloads _were_ available.

Problems with the O/A QEDCP.

Since the O/A and H/R QEDCPs were very similar, a pilot run was not carried out. This, however, proved to be a mistake. One operator wrote on his returned form "only applicable to public hauliers." A telephone call to this operator confirmed that he had not realised that the simulation referred to the transportation of his own product. The same call revealed another problem; some of the O/A operators were regional bases of larger companies. Asking them to give a cost and price for transporting goods to Newcastle (an area far outside their geographical coverage) was, therefore, unrealistic. On further consideration, it was also felt that asking firms without 38 tonners to transport 23 tonnes of goods was unwise.

Telephone calls were thus made to all the O/A operators to rectify the situation. The Newcastle location was changed to Plymouth in those cases where the respondents were regional bases. The delivery location of one firm located particularly near to Plymouth was changed to Penzance. It was made clear to all the firms that the QEDCP referred to the transportation of their own goods. The firms without 38 tonners were asked to ignore the 23 tonne load.

6.2.2. Collection of data on the structural and behavioural variables.

Data on the structural and behavioural variables
influencing costs and prices was collected by means of a
questionnaire which was sent to the operators along with
the QEDCP. Some of the data had already been acquired
during the initial visits. However, because in many cases,
a year had elapsed since these visits, the questionnaire
duplicated some of the information originally obtained.
Also, the information previously obtained was not
standardised between firms (i.e. exactly the same questions
had not been asked of all the operators). A questionnaire
would provide this standardisation as well as testing
questions for the large scale survey.

A very important aspect of the research design is
establishing that the questionnaire wording is valid
(Weisberg and Bowen 1977). Construct validity is achieved
by "establishing correct operational measures for the
concept being studied." (Yin 1984).

Operationalising the variables, particularly the
behavioural variables, proved to be a difficult task
because there were no precedents in the literature.
Wording the questions so that they would relevant to the
operators and so that their exact meaning would be
understood, was greatly aided by the initial visits. These
provided a frame of reference on the kind of activity which
could be used as an example in the questions.

Knowledge of the industry obtained from the visits enabled much use of the closed ended or multichotomous questions. Cannell and Kahn (1968) say that closed ended questions can best be used where; a) there are a limited number of known frames of reference from which the respondent can answer the question. b) within these possible frames of reference, there is a known range of possible responses. c) within this range there are clearly defined choice points that approximate well the positions of the respondent.

Where these conditions were satisfied, closed ended questions were used in preference to open ended questions as they would ease the burden of work on the respondents. As Churchill (1983) points out, the probability of someone answering a question partly depends on the amount of work involved in producing an answer. Given that a considerable amount of work was needed for the simulation, it was important that work required on the questionnaire was reduced to a minimum. Open ended questions were only used when there was no obvious range of responses.

The questionnaire was divided into 8 sections, each section corresponding appproximately to one of the variables proposed in the model outlined at the end of the last chapter. In order to increase construct validity, each variable was covered by several questions.

As with the QEDCP, it was necesary to devise two

questionnaires, one for the H/R operators and one for the O/A operators. Maximum comparibility was maintained by minimising the number of questions that differed between the two questionnaires.

The following paragraphs briefly describe the 8 sections of the questionnaire. Throughout the description, the H/R format will be used.

Questionnaire

Section 1 sought to determine the level of competitive pressure as viewed by the respondent, where competitive pressure comprises the direct level of perceived competition from other operators as well as the more indirect competitive pressure from the external environment, such as the general state of the economy. Questions 1.1 to 1.4 gauged the perceived level of competition directly while questions 1.5 to 1.7 gauged the wider competitive pressure bearing on the firm.

Section 2 sought to give a thorough picture of the information gathering, or search process. Questions 2.1 and 2.6 sought to discover whether operators monitored other hauliers' costs and rates, questions 2.3 and 2.7 to find out how and questions 2.4 and 2.5 to discover why. Questions 2.8 and 2.9 considered the monitoring of general transport news. Question 2.9 included a dummy option (option g) to test the honesty of the respondents.

Sections 3 and 4 covered the stated goals of the

operators, how they were formalised (budgets and targets)

and incentives for achieving them (performance monitoring).

The stated goals of the operators were covered by questions

3.1, 4.1 and 4.4. Question 3.1 asked operators to state

what they considered to be the objectives of their firm,

whilst questions 4.1 and 4.4 sought to determine whether

operators sought to minimise costs. The questions were

interspersed between sections so that the one question did

not influence the answers to the others. Questions 4.2 and

4.3 concerned the formalisation of the goals. It asked

about the frequency and methods of setting budgets and

targets. Question 4.5 sought to determine the incentives

for achieving them. The latter question along with

question 5.2e sought to discover the level of performance

monitoring and the pressure on individuals to minimise

costs.

Section 5 contained a series of questions on the structure

of the firm in terms of the geographical coverage, the

rigidity of the management control systems and departmental

hierarchy.

Section 6 covered the management structure. It sought to

determine the level of owner involvement in the firm as

well as the legal form of the company.

Section 7 covered the educational achievements and

experience of the respondents.

Some of the questions on the O/A questionnaire differed from those on the H/R questionnaire, but the structure of the questionnaire remained the same.

The questionnaire and QEDCP were sent to the 18 operators along with a covering letter (shown in appendix 4c).

Replies were received from 14 operators, although the QEDCP was only completed fully by eleven.

6.3. Results

The following pages summarise the results from the questionnaire and analyse the responses from the QEDCP. The reader is referred to the chapter appendix for a more detailed presentation of the results from the questionnaire.

6.3.1. Results from the questionnaire

The purpose of the questionnaire was to standardise and crystallise many of the observations of the previous chapter to enable intercompany comparisons through statistical analysis. Because of this, discussion of the results from the questionnaire is minimised as it would, in

most cases, merely be duplicating the discussion of the previous chapter. Discussion in this chapter is mostly confined to the relevance or validity of the questions. A detailed discussion of all the results is to be found in Chapter 8

The following considers the replies from the 14 respondents.

a)   Competitive Pressure

As would be expected, the level of competitive pressure was viewed as being high by most operators. When asked directly about the level of competition, 57% stated that it was either "extremely" or "very" intense. However, when asked how many direct competitors they had, the replies were surprisingly low, ranging from 0 to 10 and averaging 4. Most H/R operators stated that their main competitors were very similar to them in terms of size, type of vehicle used, range of activities and geographical location. Thus direct competition was perceived as intense but confined to a relatively small number of like competitors.

Considering the wider aspects of competitive pressure, 79% of the operators stated that the road haulage industry was either "fairly" or "very" depressed. Furthermore, the national economy was also viewed as depressed, though slightly less so than the road haulage industry. Despite this gloomy picture, 57% of the operators were optimistic for the future, stating that they expected business to

improve in the coming year.

Overall, H/R operators perceived the level of competitive
pressure to be more intense than the O/A operators,
the smaller firms perceived it to be more intense than the
larger firms and owner managed firms viewed as more intense
than non owner managed firms (though in this study, the
smaller firms were generally the owner managed firms which
were also often the H/R firms). These results certainly
coincide with the view obtained from the initial on-site
visits, which suggests that the questions were valid.

b) Information Handling

All except one operator tried to find out haulage rates
charged by other operators. To do this, they used several
methods in conjunction, but the most popular were by
talking to other operators and by talking to customers.
The main reason given for monitoring rates was not
to keep their own rates competitve, but "out of interest".
Other operators' costs were monitored by only 64% of the
operators. Again, those who monitored costs did so using
several methods in conjunction; the most popular being
through published cost tables and, again, by talking to
other operators.

Operators also gathered more general transport information
by subscribing to and reading transport magazines such as

Commercial Motor (CM) and Motor Transport (MT). All the
operators received at least two such publications and three
of them received five. Many of the operators also attended
conferences, courses and other meetings to keep up to date
with the transport news.

Thus, most of the operators were keen to gather
information on costs and rates as well as general transport
issues.

c) Objectives of operators

The most popular stated objective (ticked by 86% of the
operators) was to provide a good service to their
customers. This was followed in popularity by maximising
vehicle utilisation. By far the most popular financial
objective was to maximise return on capital (ROC), with 64%
of operators stating that this was a major objective. This
compares to only 36% of operators who stated that
maximising profits was a major objective. In fact, as many
operators admitted to seeking only to make an acceptable
level of profits as stated seeking to maximise profits.
Furthermore, 22% of the operators stated that they did not
seek to maximise any of the financial objectives.

In response to the question "do you try to minimise
costs, keep costs within budgets or keep costs at an
acceptable level", 29% of the operators admitted to not

seeking to minimise costs. This is a high percentage
considering firstly that there is likely to be some
pressure on operators to say that they tried to minimise
costs and secondly that a few more operators may have
admitted to not succeeding in minimising costs.

Thus, it was shown in the previous chapter that
satisficing was prevalent among the operators visited.
This section shows that operators do not mind admitting
that this is so. If it is assumed that those operators who
did not have cost frameworks were satisficing, then it is
not necessarily those who satisfice that admit to doing so.
However, it is the subjective perceptions of the operators
that are important and this section demonstrates that
operators will answer questions on this subject honestly.

d) Budgets and Targets

A total of 70% of the operators said that they had targets
for their major objectives. Of these, 78% revised them
only annually. Operators use of budgets was similar, with
77% of the operators stating that they had budgets for both
current and capital expenditure. Again though, most
updated them only annually. All but two said that they
were calculated from scratch. From the on site
observations, this is a true picture except that fewer
operators said that they calculated budgets from scratch.

e) Performance Monitoring

Three of the seven operators with more than one depot had
their performance compared with other depots in the
country. The most common functions of head office were to
analyse the depot's performance data (done in 6 of the 7
cases), to set budgets for the depots (5 of the 7 cases)
and to specify the form of their costing systems (4 of the
7 cases). Thus, head offices had quite a high degree of
control over the depots.

f) Education

Most of the operators had few formal educational
qualifications. Only 14% of them had 'A' levels or above
and 45% had no formal educational qualifications at all.
On the other hand, most of the respondents had a great deal
of experience in the industry. Thirty six percent of them
had been in their respective firms for more than 20 years
and the overall average was 14 years. Thus, the person
responsible for costs relied more on experience than on
formal education.

g) Structure

The number of vehicles based at the respondents' depots

ranged from 8 to 100. There was no real difference between the numbers in the O/A and H/R depots. However, if the number of vehicles in the respondents' entire companies are considered, the O/A respondents were larger than the H/R companies. As would be expected, since transport is only a small part of the O/A companies, O/A operators had many more employees than H/R operators.

All but one of the H/R operators were located solely in the South West of England. This contrasts with the O/A operators of which only two were based solely in the South West.

6.3.2. Results from the QEDCP

The results of the 11 fully completed QEDCPs will be analysed by first considering the questions relating to costs and then considering the questions relating to rates.

The costs per mile given by the 11 operators for the basic job opportunity are shown in Table 6.1.

TABLE 6.1.

COSTS PER MILE FOR THE BASIC JOB OPPORTUNITY

pence

Firm	10 tonne load	20 tonne load	23 tonne load
17	92	92	92
12	54	80	87
14	85	85	85
10	89	103	103
15	54	170	—
16	100	118	—
2	58	72	78
3	72	97	105
4	53	66	72
6	100	100	100
7	43	65	72

Direct comparisons cannot be made between firms because of the mileage factor (i.e. each firm was a different distance from its delivery point), which distorts such analysis. However, although inter-firm comparisons of absolute costs cannot be made, comparisons of percentage changes in costs from that given in the original job opportunity, are perfectly valid.

Table 6.2 shows the difference made to costs by load size.

TABLE 6.2

DIFFERENCE TO COSTS PER MILE MADE BY LOAD SIZE

<div align="right">percentages</div>

Firm	Increase from 1OT to 2OT (100%)	Increase from 2OT to 23T (15%)
17	O	O
12	48	9
14	O	O
10	16	O
15	215	—
16	18	—
2	24	8
3	35	8
4	25	9
6	O	O
7	51	11

Considering first the change in costs resulting from the increase in load from 10 tonnes to 20 tonnes, (i.e. a 100% increase in payload), the cost increases range from 0% to 218%, quite a considerable range. Three of the eleven operators stated that the load increase would make no difference to costs. This is partly explained by the fact that two of these operators stated that they would use the same weight vehicle for both loads. Most of the firms said that the percentage increase in costs would be substantially less than the percentage increase in payload, suggesting the existence of considerable economies of scale at the individual vehicle level.

There was greater agreement on the increase in costs of carrying a 23 tonne load as opposed to a 20 tonne load. Four of the five H/R operators gave a response within three percentage points of each other. They agreed that a 23 tonne load using a 38 tonne vehicle would cost

approximately 9% more to carry than a 20 tonne load using a 32 tonne vehicle. Unlike the H/R operators, none of the O/A operators said they would use a 38 tonne vehicle for the 23 tonne load and a 32 tonne vehicle for the 20 tonne load. It is difficult, therefore to make direct comparisons of the cost increases for the O/A operators.

Variation of costs with distance

Figure 6.1 shows how costs per mile vary with mileage.

Unlike the costs given in the original job opportunity, costs shown in fig 6.1 are directly comparable. Figure 6.1 shows that there were considerable differences in costs between firms. The cost per mile for 100 miles ranged from 63p to 218p and averaged 107p. Over 400 miles, cost per mile ranged from 68p to 109p and averaged 83p. Whilst for 450 miles, costs ranged between 66p and 112p and averaged 82p. The range of costs was, thus, much less in the 400 and 450 mile categories than in the 100 mile category.

The wide range of costs belies the considerable agreement between some firms on costs. In the 100 mile category, three firms said the trip would cost £1 per mile. In the 400 mile category, four operators agreed on 75p per mile and a fifth said 70p. In the 450 mile category four operators agreed on a cost per mile in the range 73p to

FIGURE 6.1

RELATIONSHIP BETWEEN COSTS AND MILEAGE

COSTS PER MILE PENCE

Legend: 100 MILES · 400 MILES · 450 MILES

Firms (x-axis): FIRM 17, FIRM 12, FIRM 14, FIRM 10, FIRM 15, FIRM 16, FIRM 2, FIRM 3, FIRM 4, FIRM 6, FIRM 7

75p.
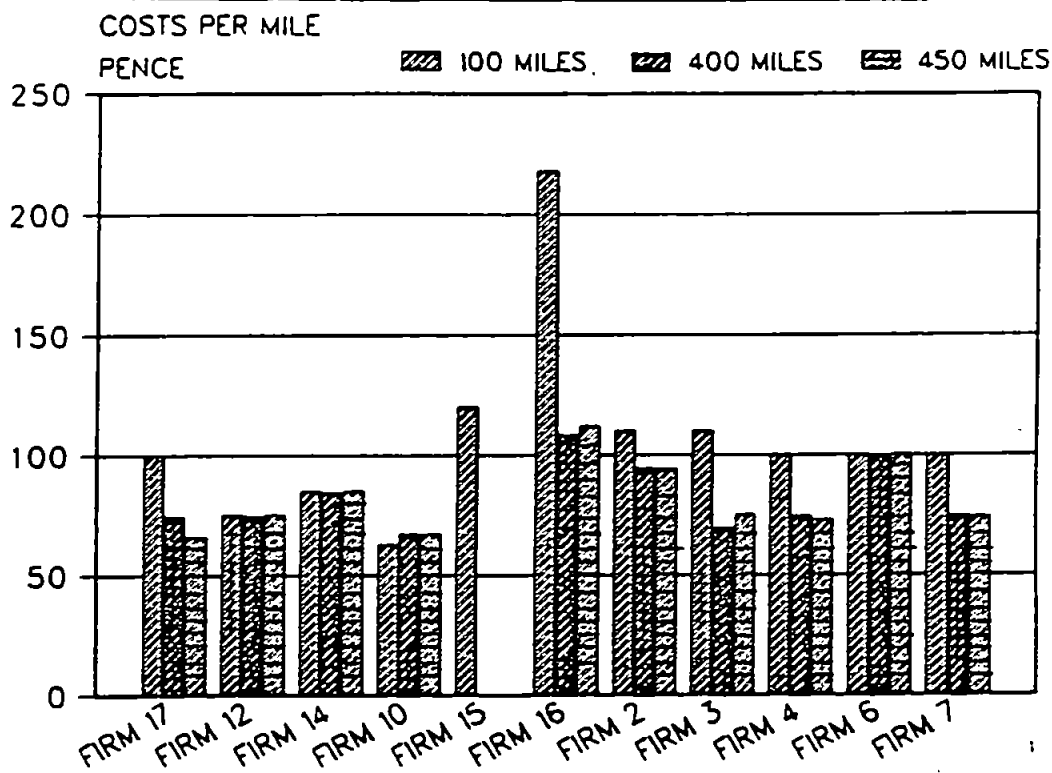
The main difference between the costs given by the O/A
operators and those given by the H/R operators was the
greater variation in costs in the O/A case, as shown by
Table 6.2

TABLE 6.3

STANDARD DEVIATIONS IN COSTS - BY TYPE OF FIRM

pence

	100 miles	400 miles	450 miles
H/R	5.47	13.5	12.79
O/A	56.55	16.05	18.93
All Operators	40.26	14.00	15.28

In the 100 mile category, the standard deviation in costs
was far greater in the O/A case than in the H/R case. The
difference is far less pronounced in the 400 and 450 mile
categories. An explanation for the greater variation in
costs in the O/A sector could be that the H/R operators
were asked to carry a standard product (peas), whereas the
O/A operators carried a greater variation of products.
Overall, however, there was very little difference in costs
between H/R and O/A operators.

The relationship between costs and mileage is further
illustrated in Table 6.4 which considers the changes in
cost per mile between the distance categories.

TABLE 6.4

CHANGES IN COST PER MILE OVER DISTANCE

percentages

Firm	Increase from 100 to 400 miles	Increase from 400 to 450 miles
17	-25	-12
12	0	0
14	0	0
10	9	-1
15	-	-
16	-50	3
2	-36	7
3	-14	-1
4	-25	-3
6	0	0
7	-25	-1

Table 6.4 shows that in three cases the cost per mile was invariant with mileage. Seven of the firms believed there to be economies of distance, especially between 100 and 400 miles. Three firms, however, estimated that cost per mile would increase as mileage increased between particular mileage categories.

Again, there was some agreement on the magnitude of the changes in cost resulting from an increase in the mileage. Three firms agreed that costs would decrease by 25% as mileage increased from 100 to 400 miles and four firms said that costs per mile would decrease by 1% as mileage increased from 400 to 450 miles.

Relating costs to distance can probably best be achieved using regression analysis. The regression of distance on cost gives an equation in which the constant can be

interpreted as the standing costs and the coefficient as the running cost per mile. Regressing distance on cost using the costs given for 100, 400 and 450 miles (which assumed a 20 tonne load) and the costs and mileages given for the 20 tonne load from the original job opportunity (i.e. giving 41 observations from 11 firms), gives the following equation, where the figures in brackets are T statistics:

$$COST = 15.3 + 0.843 \text{ MILEAGE}$$
$$(0.64) \quad (13.3)$$

$$R^2 = 82\% \text{ (adjusted for degrees of freedom)}$$

The equation suggests that standing costs for transporting a 20T load are £15.3 whilst running costs are 84p/mile. The standard error of the constant is very high giving a correspondingly low T-statistic, indicating that the constant is not statistically significant at the 5% level. This may be because operators do not take standing costs into account when costing, which the previous chapter showed to be partly true. However, it may also reflect the fact that no costs are given for mileages below 100 miles, so the intercept is subject to a substantial degree of variance. The mileage coefficient is very significant. The high value for R^2 shows, as expected, that there is a high correlation between cost and mileage.

The equation above includes costs given by those using

vehicles other than 32 tonners to transport the 20T load.
Using only the cost data given by those using 32 tonners,
the regression equation becomes:

$$COST = 17.3 + 0.882 \ MILEAGE$$

$$R^2 = 88.7\% \ (adjusted)$$

The equations are very similar, though surprisingly, the
running cost element is greater when only the 32 tonners
are used than when the mixture of 38 tonners and 32 tonners
are used.

Cooper and Doganis (1985, published subsequent to this
study), considered the cost of transporting goods various
distances using 32 tonne vehicles. They asked each of the
18 London based firms in their study to cost a selected
trunk run which the firms in question performed frequently.
Regressing distance against cost gave the equation:

$$COST = 26.44 + 0.424 \ KILOMETERS$$

or $$COST = 26.44 + 0.678 \ MILEAGE$$

$$R^2 = 95\%$$

Cooper and Doganis, then, estimated that running costs
were lower and standing costs higher than those found in
this study. Thus, at low distances (between 25 and 100

miles), the two equations give very similar costs, but as the distance increases, costs given by the equation based on this study get progressively higher than those given by the Cooper and Doganis equation. One possible explanation for the differences in the equations would be that operators in the South West have different costing practices than those in London and include more costs as running costs and fewer as standing costs than those in London. This might be the case if, for instance, operators in the South West hired more casual labour than their counterparts in London. Since neither study used a representative sample, however, there is no real reason to expect that the two equations would be equal.

Rates

Only one of the O/A operators gave rates. The rates given by the exceptional firm were fixed i.e the same rate was given for transporting the 10 tonne load as the 23 tonne load and they were totally invariant with the changes in conditions. They were, therefore, omitted from the analysis.

The rates per mile given by the 6 H/R operators are shown in Table 6.5.

TABLE 6.5.

RATES PER MILE OF THE H/R OPERATORS

pence

Firm \ Load Size	10 tonnes	20 tonnes	23 tonnes
2	78	104	115
3	86	136	152
4	66	92	105
6	48	97	111
7	48	78	91
9	134	168	176

Again because of the mileage factor, direct comparisons
cannot be made between firms. Instead, percentage changes
from the rate given for the original "job opportunity" must
be considered. Table 6.6 shows the difference made to
rates by load size.

TABLE 6.6

DIFFERENCE MADE TO RATES BY WEIGHT OF LOAD

Firm	Increase from 10T to 20T (100%)	Increase from 20T to 23T (15%)
2	33	11
3	58	12
4	39	14
6	102	14
7	63	17
9	25	4

The increase in payload from 10 tonnes to 20 tonnes
elicited a considerable range of rate increases from the
H/R operators; from 25% to 102%. The percentage increase
in rates was, in most cases, considerably less than the
percentage increase in payload, suggesting that consumers
receive some of the advantages gained from the economies of
scale. As with costs, there was far more agreement on the
rate increases subsequent upon the payload increase from 20

tonnes to 23 tonnes. Most of the operators said that they
would increase by about 13%.

Subsequent Questions

The percentage change in rates from the rate given for the
original job opportunity following the changes in the
firms' demand and supply conditions are shown in Fig 6.2
(a) to (d).

Fig 6.3 shows that firms do not respond to all changes in
demand and supply conditions in the same way; i.e reaction
to an increase in the urgency of delivery of the load is
not the same as the reaction to an increase in the value of
the cargo to be carried. Changes in the urgency of the
load, the regularity of custom and the availability of
backloads caused the greatest reaction in terms of the
numbers of operators who changed their rates as a result of
the changes in these conditions (4 operators out of 6).
Understandably, the withdrawal of the backload caused the
greatest reaction in terms of the magnitude of the rate
increases, ranging from 5% to 100%. The two firms that
showed no rate increase following the withdrawal of the
backload said that they would now prefer to subcontract the
loads. Thus all the operators reacted in some way to a
withdrawal of the backloads, but the reaction was different
between firms.

An increase in the urgency of the loads to be transported

FIGURE 6.2a

DIFFERENCE MADE TO RATES BY URGENCY OF LOAD

FIGURE 6.2a — DIFFERENCE MADE TO RATES BY URGENCY OF LOAD. PERCENTAGE INCREASE. 10 TONNES, 20 TONNES, 23 TONNES. FIRM 2, FIRM 3, FIRM 4, FIRM 6, FIRM 7, FIRM 9.
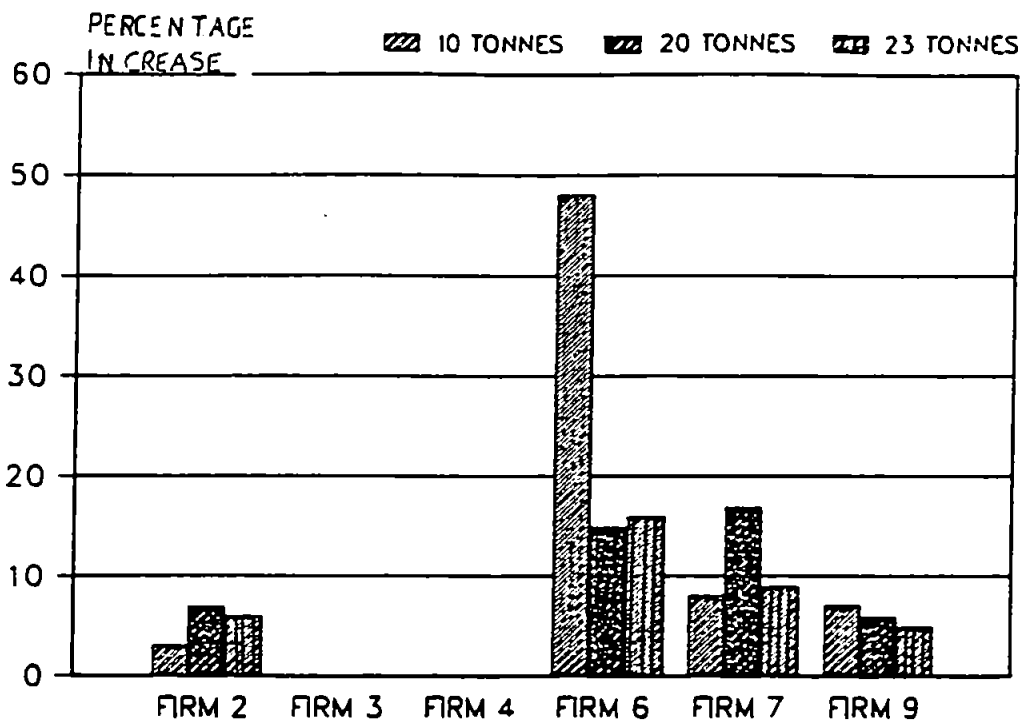
FIGURE 6.2b
DIFFERENCE MADE TO RATES BY WITHDRAWAL OF BACKLOADS

FIGURE 6.2b — DIFFERENCE MADE TO RATES BY WITHDRAWAL OF BACKLOADS. PERCENTAGE. 10 TONNES, 20 TONNES, 23 TONNES. FIRM 2, FIRM 3, FIRM 4, FIRM 6, FIRM 7, FIRM 9.
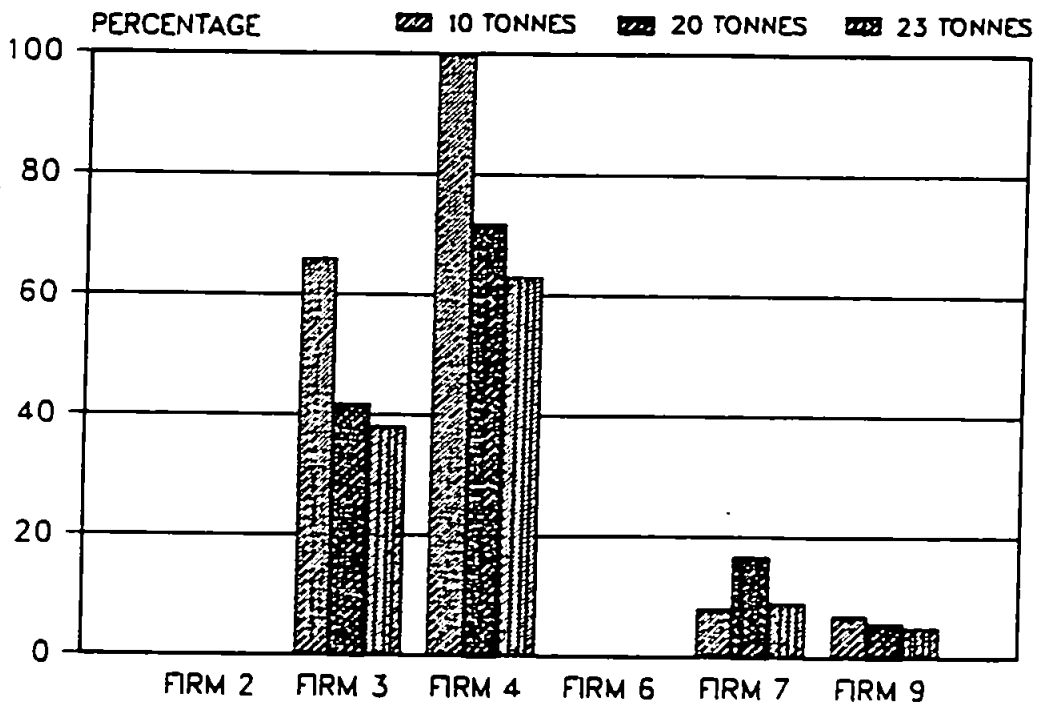
FIGURE 6.2c

DIFFERENCE MADE TO RATES BY FIRMS' NEED FOR WORK

PERCENTAGE INCREASE   ▨ 10 TONNES   ▨ 20 TONNES   ▨ 23 TONNES

FIRM 2   FIRM 3   FIRM 4   FIRM 6   FIRM 7   FIRM 9
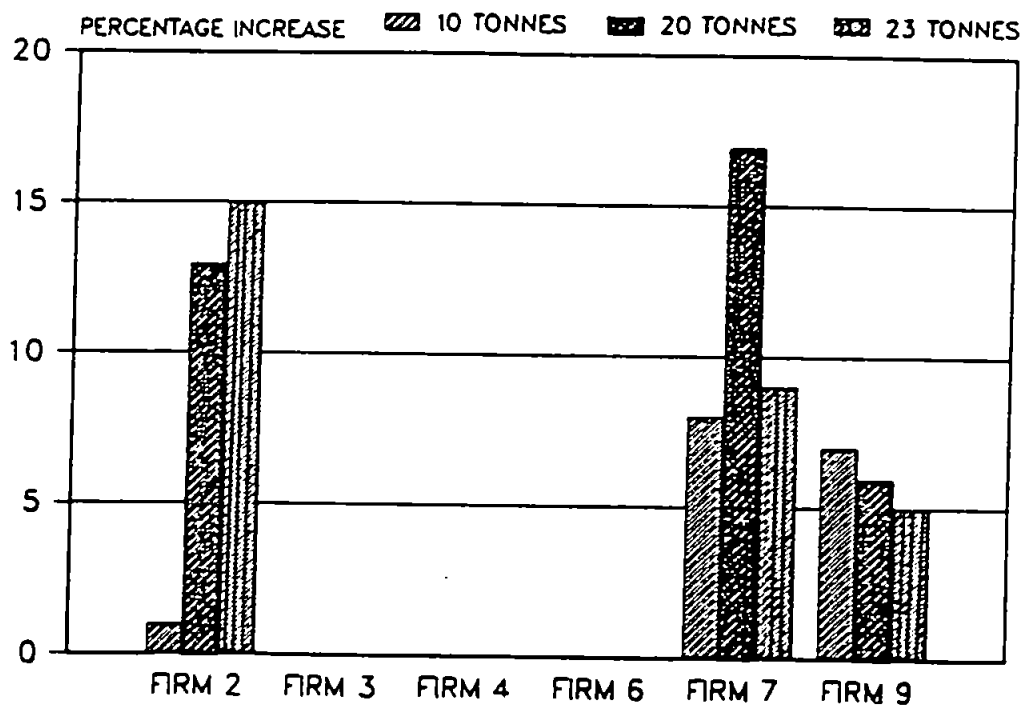
FIGURE 6.2d

DIFFERENCE MADE TO RATES BY VALUE OF CARGO

PERCENTAGE INCREASE   ▨ 10 TONNES   ▨ 20 TONNES   ▨ 23 TONNES

FIRM 2   FIRM 3   FIRM 4   FIRM 6   FIRM 7   FIRM 9
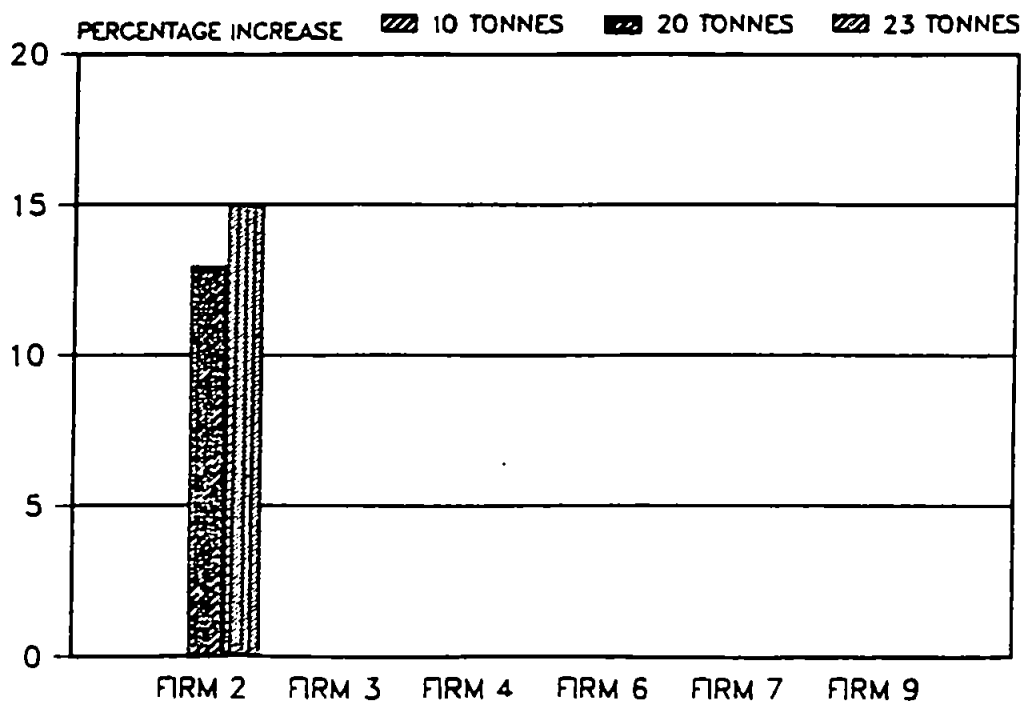
also caused quite a reaction. In this case, the change in rates ranged from 3% to 48%, again quite a substantial difference. As in the case of the withdrawal of backloads, the two firms who said that rates would not increase a a result of the increse in urgency of loads, stated that they would now prefer to subcontract the loads.

Four of the six firms stated that they would decrease their rates if the job was for a valued customer. The range of the rate decreases was quite narrow - from 2% to 10% and the average was around 5%. Again, this shows, however, that rates were fairly sensitive to changes in the conditions of the customer and the firm itself.

Rates were least sensitive to a change in the value of the cargo to be carried. Only one firm said that they would increase their rates if the value of the cargo increased from £500 to £1500 per tonne.

Overall, the magnitude of the rate changes seemed to bear litle relation to the weight of the load. In some cases the average percentage increase in rates for the 20 tonne load was greater than that for the 10 tonne load, but this was by no means always the case.

The above analysis has shown that firms react in different ways to changes in the demand and supply conditions facing them. Two firms changed their rates on every occasion except for a change in the value of the load, and changed

them by a different percentage according to the weight of the load. They both, however, made no differentiation in rate increases between an increase in the urgency of the load and their firm's need for work. Thus, for these two firms, rates were sensitive to changes in the demand and supply conditions facing them. At the other extreme, one firm changed its rates only in response to a withdrawal of the backloads; its rates were completely insensitive to changes in other conditions. Two firms preferred to subcontract the loads rather than to increase rates. Thus, some firms react to change in conditions by altering their rates to suit, and others prefer to maintain their rates at a constant level and subcontract the loads in order to achieve this. Yet other firms do a mixture of the two.

Figs 6.3 and 6.4 show respectively, the percentage increase in rates from the original rate for the job to give the respondent what they consider to be a fair rate for the job and the maximum percentage reduction from the original rate that they would accept for the job.

Only three of the six firms said that they thought rates should increase to give them a "fair rate". The other three firms desired rate increases of between 8% and 46%. Overall then, rates do not appear to be as "unfair" as the transport press suggests. This is supported by the fact that 4 of the 6 firms said that they would be prepared to accept a lower rate for the job. The percentage decreases

FIGURE 6.3

PERCENTAGE INCREASE IN RATES CONSIDERED NECESSARY TO GIVE A FAIR PRICE
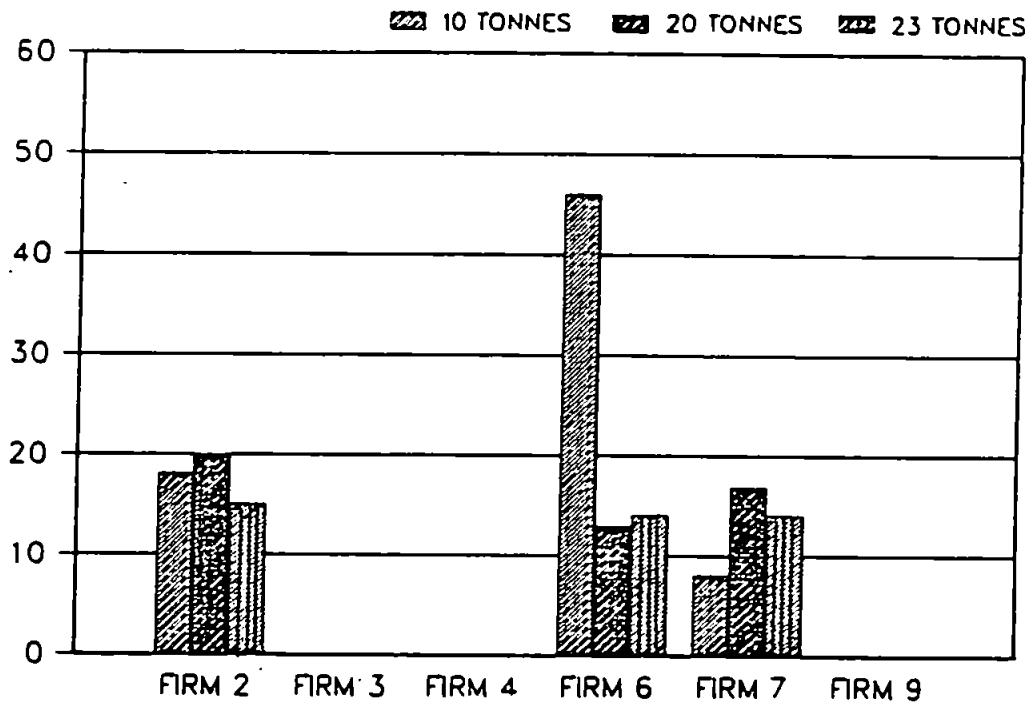
FIGURE 6.4

MAXIMUM PERCENTAGE REDUCTION IN RATES
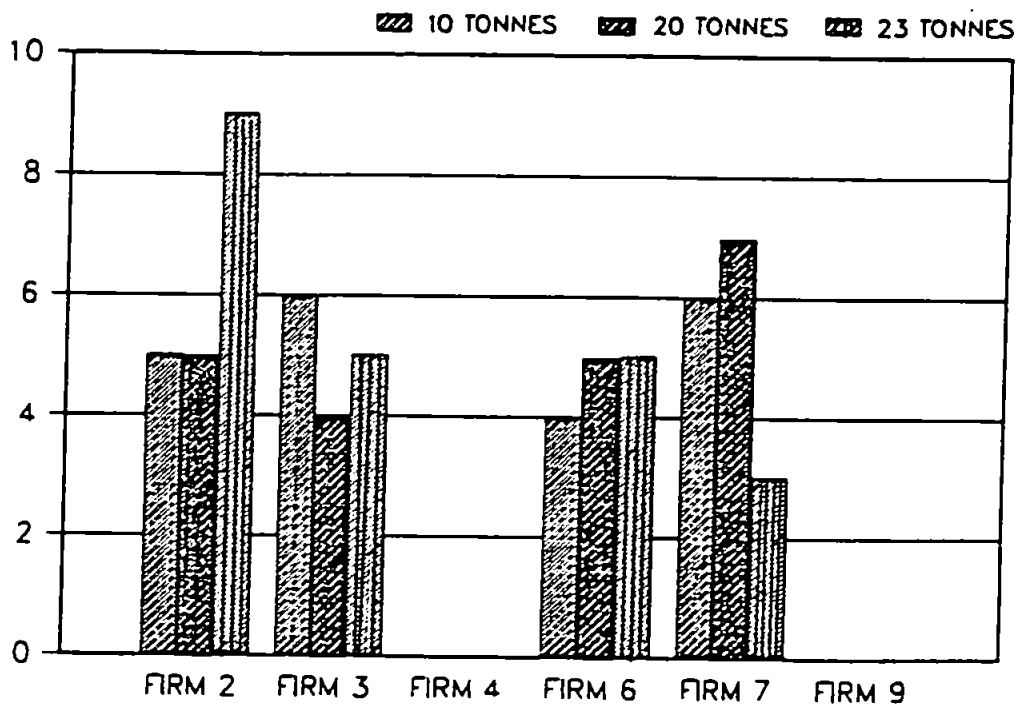
ranged from 3% to 4% and averaged about 5%.

Discussion

The results from this in-depth survey are again supportive of the behavioural theory. Where costs were directly comparable between firms, it was shown that they differed considerably between firms. Costs are a culmination of all the standard operating procedures used in running the business and in the collation of costs. As each firm has slightly differing methods of operating and calculating costs, each firm has different costs: Similarly with the percentage increase in costs between loads.

Behavioural theory (as discussed in Chapter 4) states that rates are determined on a subjective markup-on-average-cost basis. The precise magnitude of the markup, it says, depends on perceptions of what the market will bear and this in turn is obtained from feedback from the market. The findings above are certainly consistent with this scenario. Rates were fairly sensitive to changes in demand and supply conditions facing the firms, and the responses, in terms of changes in rates, differed according to which particular condition changed. As would be expected, the changes in rates following any one change in condition differed between firms; the rate setters each had a different perception of what he market would bear and thus what constituted a "rational" rate increase.

198

6.3.3. Relating the questionnaire and the QEDCF

Having considered the results of the questionnaire and the QEDCF separately, the next stage is to relate the two. With such a small number of firms, any relationships. emerging are unlikely to be statistically significant; they can merely be suggestive. Since rates were only obtained for 6 firms, it was not possible to make even tentative suggestions as to their determination. This section, therefore, is concerned only with costs.

A preliminary stage to linking costs to the variables under study is to group the firms in terms of likeness on each individual variable. In the questionnaire, each of the variables was covered by several different questions. A method of combining the answers to give an overall measure for each variable was needed. The use of cluster analysis was considered to deal with this, but as this would have involved assigning somewhat arbitrary values to concepts in the questionnaire, it was decided that informed judgement would be equally valid. Accordingly, each firm was assigned a binary value for each variable according to whether there was a high or low presence of that variable. The criteria used for assigning a value of 1 (indicating that there was a high presence) were as follows:

Variable	Criterion
Management Structure	Any indication of owner management i.e. affirmative answers to questions 7.1 or 7.2
Competitive Pressure	Competition extremely or very intense = 1 \ 2 out of 3 Road haulage ind. fairly or very depressed = 1 } ones = overall 1 Economy fairly or very depressed = 1 /
Stated Goals *	Maximise profits or R.O.C.
Information Handling	Monitor both rates and costs
Budgets and Targets	Written budgets and targets
Structure	More than 20 vehicles
Education	Formal qualifications above 'O' levels

* Those with more ambitious goals are henceforth referred to as high aspirers and those with lower ambitions are referred to as low aspirers.

The assignment of a binary value to each firm for each variable results in a binary matrix which effectively divides the firms into two groups for each variable (i.e. one group of firms with a high presence of a particular variable and one with a low presence). Using this binary matrix, the inter-group differences in costs can be calculated to gauge the sensitivity of costs to each variable. The results of such a calculation for the 100 mile category are shown in Table 6.7.

TABLE 6.7

DIFFERENCE TO COSTS MADE BY ABSENCE OR PRESENCE OF STATED

VARIABLE

Variable	Number in group	Cost per mile
Owner managed	6	91
Non owner managed	5	126
High information handling	9	106
Low information handling	2	110
Use budgets and targets	7	117
No budgets and targets	4	90
High performance monitoring	3	102
Low performance monitoring	8	109
High education	4	84
Low education	7	120
High competitive pressure	8	108
Low competitive pressure	3	105
Large	7	93
Small	4	132
High aspirers	8	114
Low aspirers	3	88

Table 6.7 shows that for any one variable there are considerable variations in costs between groups. Costs for large firms are, for instance, 39p/mile lower than those for smaller firms, whilst those firms with owner managers have costs which are 35p/mile lower than those without owner managers. None of the inter-group cost differences are statistically significant. This probably reflects the small numbers involved.

Table 6.7 considers the variables individually. While
this is adequate for a preliminary analysis, some method of
combining the variables to analyse their joint influence
would be useful. One method available is cluster analysis.
As this is used considerably in the following chapter,
a brief description of the method follows.

Cluster analysis is a method of numerical taxonomy whose
development can be mainly attributed to Sokal and Sneath
(1973). It is described by Aldenderfer and Blashfield
(1984) as "a multivariate statistical procedure that starts
with a data set containing information about a sample of
entities and attempts to reorganise these entities into
relatively homogeneous groups."

There are now literally hundreds of clustering methods
which have been devised for many different subjects and
purposes. One of the problems with cluster analysis is
that each method can yield a different set of clusters.
(Everitt 1980). In this study, two methods were used –
single linkage and Wards method. Both these methods are
'hierarchical agglomerative' methods i.e. "they start out
with N single point clusters. At the next stage the two
most similar points are placed in a cluster. At each step
the proximity matrix is recalculated in order to compute
the relationship of the new clusters with the remaining
entities. At the end of the process all N points are
grouped in one larger cluster." (Jain et al, 1982).

Another problem with cluster analysis is that there is a
lack of reliable statistical tests for the significance of
the clusters. A consequence of this is that the optimal
method used and the optimal number of clusters considered
have to be decided on largely heuristic grounds. As Mather
(1976) states "as with most exploratory work, common sense
and a knowledge of the phenomena under investigation are
most important; servile reliance on the result of an
arbitrary optimality measure is not likely to reveal
anything of fundemental importance." The clusters which
emerged from the single linkage method seemed intuitively
less sensible than those which emerged from the use of
Ward's method. For several of the variables the single
linkage clusters consisted of a couple of single entity
clusters and one large cluster. This was inappropriate for
the purpose of analysis. Wards method was, therefore,
adopted for use throughout.

Using the binary matrix obtained above, cluster analysis
was used to group the firms into two clusters. The
emerging clusters were:

Cluster 1	Cluster 2	
Firm 17	Firm 14	Firm 3
Firm 12	Firm 15	Firm 4
Firm 10	Firm 16	Firm 6
Firm 7	Firm 2	

Cluster 1 comprised firms who had more than average owner managers, education, budgets and targets and were larger. Cluster 2 consisted of those which had higher aspiration levels, monitored costs and rates and had their performance monitored.

In all three mileage categories, cluster 2 firms had higher costs per mile than cluster 1 firms. The inter-cluster cost differences were greatest in the 100 mile category, as shown in Table 6.8.

<u>TABLE 6.8</u>

<u>INTER-CLUSTER DIFFERENCE IN COSTS</u>

Costs per mile (p)

	100 miles	400 miles	450 miles
Cluster 1	84.5	73.24	70.5
Cluster 2	110.0	89.0	90.0

Again, the differences are not significant because of the small numbers involved. However, the analysis suggests that the variables under scrutiny certainly have some influence on costs. It suggests that a combination of high education, owner managemement, budgets and targets and large size serve to keep costs at a lower level, whilst a combination of high aspiration levels, monitoring of costs and rates and high performance monitoring makes costs higher. This is reasonably consistent with the individual variable influence analysis of Table 6.7

Another method of combining the variables to determine
their joint influence on costs is regression analysis,
although because of the small numbers involved, such
analysis can only be suggestive. Again using the binary
matrix obtained above (indicating that each variable was
entered as a dummy variable), three regression analyses
were undertaken with the cost per mile of transporting 20
tonnes of goods 100 miles, 400 miles and 450 miles as the
three dependent variables. Summary results of the analysis
are shown below where the figures in brackets are
T-statistics. The full results are shown in Appendix 5.

100 miles

$$COST/MILE = 345 - 143\ b - 55.5\ h - 25.5\ l - 95.8\ m +$$
$$(6.75)\quad (-6.53)\quad (-4.44)\quad (-2.04)\quad (-3.86)$$

$$78.7g - 42.5f\quad - 101d - 7.1e$$
$$(4.51)\quad (-2.38)\quad (-8.73)\quad (-0.61)$$

$R^1 = 99.0\%$
  or 94.9% adjusted
 No. of observations = 11

All variables except variable e and l are highly significant
at the 5% level (T>2.23).

400 miles

$$COST/MILE = 236 - 61.8\ b - 28.7\ h - 27.8\ l - 57.3\ m +$$
$$(14.24)\quad (-9.81)\quad (-6.08)\quad (-6.96)\quad (-7.17)$$

$$39\ g - 46.2\ f\quad - 40.7\ d - 23.3\ e$$
$$(6.75)\quad (-8.08)\quad (-10.91)\quad (-6.26)$$

$R^1 = 99.9\%$
  or 98.7% adjusted
No. of observations = 10

All variables are highly significant at the 5% level
(T>2.26)

450 miles

$$COST/MILE = 256 - 71.5\ b - 32\ h - 32.6\ 1 - 74\ m +$$
$$(25.71)\ (-16.97)\ (-11.31)\ (-13.55)\ (-15.32)$$

$$39\ g - 52.5\ f - 38\ d - 26\ e$$
$$(11.26)\ (-15.3)\ (-16.99)\ (-11.63)$$

$R^2 = 99.9\%$
or 98.7% adjusted
No. of observations = 10

All variables are highly significant at the 5% level.

where b = Owner managememt
       h = Information Handling
       1 = Budgets and Targets
       m = Performance Monitoring
       g = Education
       f = Competitive Pressure
       d = Structure
       e = Aspiration Levels

The regression analysis suggests that the 8 variables explain a very significant proportion of the variation in cost per mile for the three mileage categories (as shown by the very high adjusted R^2). In all three cases the variables are individually highly significant (as shown by the very high T-ratios). In fact the only statistically insignificant variables were the use of budgets and targets variable and the aspiration level variable in the 100 mile category.

In multiple regression, little can be interpreted from the magnitude of the coefficients. What can be said, however, is that all the variables except education have a negative influence on cost. The positive sign attached to the education coefficient is a little surprising as it suggests that costs increase with the education of the respondent. A possible explanation for this would be that those who are

less well educated have less knowledge of their costs and are, therefore, undercosting.

The regression analysis suggests then, that the structural and behavioural variables have a large influence on cost, although it must be noted that correlation does not necessarily imply causation. With such a small number of firms and a relatively high number of variables, considerable caution should be exercised in the interpretation of the significance of the results. The analysis is meant only to be tentative. That the results are statistically significant, however, suggests that the subject is worthy of further research using a larger sample. This is the subject of the following chapter.

CHAPTER APPENDIX

1. COMPETITIVE PRESSURE

TABLE 6.9

LEVEL OF PERCEIVED COMPETITION

Number of operators

	Extremely intense	Very intense	Fairly intense	Not very intense	Non existent
O/A	1	1	4	1	0
H/R	3	3	1	0	0
Total	4	4	5	1	0

TABLE 6.10

STATE OF THE ROAD HAULAGE INDUSTRY.

Number of operators

	Extremely healthy	Very healthy	Fairly healthy	Fairly depressed	Very depressed
O/A	0	0	2	4	1
H/R	0	0	1	4	2
Total	0	0	3	8	3

TABLE 6.11

FUTURE PROSPERITY OF THE ROAD HAULAGE INDUSTRY.

Number of operators

	Improve	Stay as it is	Get worse
O/A	3	3	1
H/R	5	2	0
Total	8	5	0

TABLE 6.12

STATE OF THE ECONOMY

Number of operators

	Extremely healthy	Very healthy	Fairly healthy	Fairly depressed	Very depressed
O/A	0	0	2	4	1
H/R	0	0	1	4	2
Total	0	0	3	8	3

2. INFORMATION HANDLING

TABLE 6.13

METHODS USED TO FIND OUT HAULAGE RATES

Number of operators

	O/A	H/R	Total
Talking to hauliers	4	5	9
Published cost tables	3	1	4
Talking to customers	3	6	9

TABLE 6.14

REASONS FOR MONITORING RATES

Number of operators

	O/A	H/R	Total
Out of interest	4	5	9
Keep prices in line	2	4	6
Convince customers	2	4	6

TABLE 6.15

METHODS USED TO MONITOR COSTS

Number of operators

	O/A	H/R	Total
Talking to hauliers	4	3	7
Published cost tables	3	4	7
Vehicle manufacturers	2	2	4

TABLE 6.16

PUBLICATIONS REGULARLY READ BY OPERATORS

Number of operators

	O/A	H/R	Total
Motor Transport	5	6	11
Freight	5	2	7
Fleet News	2	0	2
Commercial Motor	6	3	9
Transport	2	3	5
Focus	2	0	2
Roadway	1	6	7
Truck	1	0	1
Garage and Transport	1	0	1

TABLE 6.17

METHODS USED TO KEEP ABREAST OF THE TRANSPORT NEWS

Number of operators

	O/A	H/R	Total
Attend courses	5	3	8
Attend conferences	6	4	10
Attend meetings	6	5	11
Talk to veh. manufs.	7	7	14
Talk to drivers	6	5	11

TABLE 6.18

3. STATED OBJECTIVES OF THE OPERATORS

Number of operators

	O/A	H/R	Total
Maximise profits	2	3	5
Acceptable profits	2	3	5
Maximise turnover	2	1	3
Acceptable turnover	2	2	4
Maximise growth	3	1	4
Acceptable growth	2	4	6
Maximise veh. utilisation	4	5	9
Acceptable veh. util.	0	1	1
Maximise R.O.C	5	4	9
Acceptable R.O.C	1	3	4
Give good service	5	7	12
Acceptable income	1	2	3
Provide jobs	1	0	1

4. BUDGETS AND TARGETS

TABLE 6.19

OPERATORS' USE OF TARGETS

Number of operators

	Use targets	Targets not used
O/A	5	1
H/R	4	3
Total	9	4

TABLE 6.20

OPERATORS USE OF BUDGETS

Number of operators

	Use budgets	Budgets not used
O/A	5	1
H/R	5	2
Total	10	3

211

CHAPTER 7

STATISTICAL DETERMINATION OF COSTS AND THE INFLUENCES ON COSTING APPROACHES OF OPERATORS. RESULTS FROM A LARGE SCALE SURVEY OF 2340 OPERATORS.

7.1. Introduction

The previous chapter reinforced support for the applicability of behavioural theory to road freight transport and established that the structural and behavioural variables which emerged from Chapter 4 had some influence on transport costs and operators' costing behaviour. Because of the type of survey (i.e. a detailed survey of a small number of firms), it was, however, impossible to gauge the strength of such influence and the relative contribution of the individual variables with any degree of statistical confidence. This chapter seeks to develop a statistical relationship between costs and the structural and behavioural variables under scrutiny as well as to consider the influence of these variables on operators' costing behaviour.

The chapter concentrates on costs rather than on costs and rates mainly because it was considered that on a large scale survey where no previous contact had been made between the researcher and the respondent, respondents would be unlikely to disclose both their costs and rates

because of the sensitivity of the information. Information on costs rather than rates was sought because a) the relationship between costs and the variables had already been tentatively considered in the previous chapter. b) This thesis is concerned with determinants of operators behaviour and reactions to changes in legislation. Perceived costs are more important determinants of behaviour than rates. c) Rates are somewhat dependent on costs. A knowledge of the influences on costs would, therefore, also give an indication of the determination of rates.

7.2. Research Method

7.2.1. Questionnaire

The research instrument was a large scale postal questionnaire survey which was sent to a representative sample of operators, as described below. For reasons given in Chapter 6, the questions were mostly of a closed-ended format, except where this was impossible. As the operators in this case were unknown, succinctness was of paramount importance. The questionnaire was therefore designed to be short and to the point. Many of the questions used in the questionnaire were identical to those used in the initial survey of eighteen firms. Their appropriateness and relevance to the subject as well as their intelligeability to operators had , thus, already been established.

The pilot questionnaire, which consisted of seventeen questions, is shown in Appendix 6, together with the final

questionnaire and covering letter. The following
paragraphs briefly describe the final questionnaire and
explain the rationale behind the questions.

Question 1 was an introductory question to determine
whether the firm used its vehicles wholly or mainly for O/A
or H/R operations. An additional category was included for
those who were engaged wholly or mainly in contract hire.
Thus, the same questionnaire was sent to all types of
operator.

Questions 2 and 3 covered the structure of the firm.
Question 2 asked for the number of vehicles based at the
respondent's depot and in the total company fleet. Question
3 concerned the geographical base of the firm.

Question 4 sought to determine whether the firm was owner
managed.

Question 5 asked for the respondent's view on stated
objectives of the firm.

Questions 6, 11 and 12 sought to determine the perceived
level of competitive pressure facing the firm. Question 6
asked respondents to describe the degree of success of
their firm; question 11 asked them to describe the level of
outside competition and question 12 asked what they
thought of the present state of the U.K economy.

Question 9 concerned the level of performance monitoring.

Question 10 asked O/A operators to state their main product.

Questions 13 to 15 inclusive concerned the respondent's costs and costing behaviour. Question 13(a) simply asked whether respondents calculated their transport costs. It was, therefore, a filtering question. For those who replied in the affirmative, question 13(b) offered a list of cost elements and asked them to tick which costs they took into account and the frequency with which each cost element was calculated. Question 14 concerned the level of aggregation of costing. It is quite possible for each element of costs to be calculated daily, but without knowing the level of aggregation of costs, it is impossible to determine the overall level of detail of costing.

Actual costs were sought in question 15. Question 15(a) asked the respondent to describe the largest vehicle in their fleet in terms of GVW and carrying capacity. Question 15(b) then asked the following:

"How much would it cost you to transport a full load to a destination 100 miles from your depot and return empty (i.e. a 200 mile round trip) using this vehicle."

The question was thus designed to be as generally applicable as possible, allowing responses from both O/A and H/R operators using any size of vehicle. This was

done by leaving the actual cargo unspecified and stating merely that the load was a 'full load'. It would have been impossible to ask respondents to cost a journey carrying a specified payload (as was done in the previous questionnaire) because there was no way of knowing beforehand, the size structure of the fleets. Whether the respondents costed a 'full load' by weight or by volume was covered in a subsequent question. The distance of 100 miles was specified as this emerged as the most generally applicable distance in the survey of 18 operators.

Question 17 asked the respondents for their educational qualifications.

7.2.2. Sample.

The sample was taken from the publication "Applications and Decisions" which is issued by the Licensing Authorities. In order to operate a goods vehicle (i.e any vehicle of or exceeding 3.5 tonnes GVW), the operator must hold a current Operators Licence. The licence, once granted, is valid for five years. "Applications and Decisions" is a list of the operators applying for such a licence, by Traffic Area. It is published fortnightly and, although the format differs slightly between traffic areas, contains the names and addresses of the operators, the number of vehicles to be included on the licence and the type of licence applied for (i.e. standard national.

standard international or restricted).

Since over any five year period, the numbers and nature of operators applying for a licence in any one particular year should be no different from any other year, there is no reason to believe that the sample would be anything other than random and thus that it would be totally representative of the whole population for that area. The existence of these conveniently divided address sources obviated the necessity for any other sampling procedures such as systematic or cluster sampling.

In order to achieve an appropriate level of significance in the results, it was obvious that surveying the operators applying for a licence in one traffic area in one year would be insufficient. Rather than using two years' addresses from one traffic area, it was decided that the sample should be drawn from two distinct traffic areas for one year. There were two main advantages in this:

1) Comparisons could be made between traffic areas. The South West is often viewed as somewhat "backward" in its development and attitudes. A costing model based on this area alone would not necessarily, therefore, be generally applicable. Comparisons with another area would increase the reliability of the model.

2) Since there is a very high turnover of firms in the freight industry, the most up to date addresses possible

were required. Addresses that were two years out of date
would decrease the response rate.

The two traffic areas used were the Western Traffic Area
(WTA) covering the counties of Avon, Cornwall, Devon,
Gloucester, Somerset, Wiltshire and Dorset; and the West
Midlands Traffic Area (WMTA) comprising Hereford and
Worcester, Shropshire, Staffordshire, Warwickshire, and
West Midlands. The WMTA was chosen as a contrasting area
geographically, industrially and in stage of development to
the WTA. The reason for using contrasting areas was that
if it was found that there were no differences in costs or
costing behaviour between the two areas, it could be
assumed that costs and costing practices were uniform
throughout the country. On the other hand, if there were
differences, since the two areas were at opposite extremes,
all other areas should fall between the two.

In order to reduce costs, not all of the operators
applying for a licence in the two traffic areas in 1985
were surveyed. There were two main categories of operator
excluded:

1) In "Applications and Decisions", the applications are
divided into "new" and "continuous" applications. Only the
operators applying under the latter section were surveyed
as those applying for a "new" licence may not have been
fully established.

2) Many of the operators were applying for a licence for
single vehicle. It was expected that the response rate for
these operators would be extremely low.

213

Although this reduced the number of operators in the survey quite substantially, it only reduced the number of vehicles covered by a very small percentage. Thus, in the WTA, the total number of operators applying for a licence under the "continuous" category in 1985 was 1777. The exclusion of the single vehicle operators reduced the number of operators in the sample by 603 (i.e. by 33%). However, this reduced number of operators had 94% of the vehicles. A Similar situation existed in the WMTA. Thus although a bias was introduced, it was justifiable.

The size of fleet structure (in terms of the percentage of operators with the given size of fleet) of the two traffic areas is shown in Table 7.1 which also shows the national breakdown for 1980. Unfortunately, national statistics were discontinued after 1980.

TABLE 7.1

COMPARISON OF FLEET SIZES BETWEEN AREAS.

percentages

Fleet Area \ Size	1	2-5	6-10	11-20	21-50	51-100	100+
WTA (1985)	34	45	11	6	3	1	–
WMTA (1985)	33	50	11	5	2	1	–
National (1980)	55	33	6	3	2	1	–

Sources: Collated from: WTA 1985, WMTA 1985,

Department of Transport 1980.

Table 7.1 shows a remarkable similarity between the two
traffic areas in terms of fleet structures. This contrasts
with the national breakdown, which has a much higher
proportion of single vehicle operators and a
correspondingly lower proportion of operators with more
than one vehicle. One possible explanation for this
difference would be that those operators applying for "new"
licences (which are excluded from Table 7.1) may have a
tendency to be mostly single vehicle operators. Another
explanation would be that fleet structures have changed
over the five years in question. The possibility that the
two traffic areas are unrepresentative, although unlikely,
cannot be totally ruled out.

Pilot Survey

A 10% pilot survey (i.e. 234 questionnaires) was sent out
in January 1986. The figure of 10% was chosen as this
would afford a sufficient number of responses to analyse
properly i.e. to discover whether there were any major
problems in the questionnaire. Since the subject was such
a sensitive one, a response rate of around 20% was
expected. This expectation was based on the response rate
achieved in other road freight studies with a similar
degree of sensitivity of subject. Cooper and Doganis
(1978) achieved a response rate of approximately 20% in
their survey of the reasons why O/A operators carry goods
for others. Mackie and Harding (1984) achieved a 25%
response rate from a survey asking about volume constrained
versus weight constrained loads. In the event, a response
rate of 23% was achieved in this study. The following
changes were made to the questionnaire following the pilot
survey:

1) Question 13b), concerning the frequency of costing, was
altered to include a "monthly" option which had been
inadvertently omitted from the pilot questionnaire.

2) Question 15a), which asked the operators to state the GVW
and carrying capacity of the largest vehicle in their fleet,
was extended to include the sentence."excluding abnormal load
carrying vehicles", since several of the respondents had
entered values such as 70 tonnes.

3) An additional question was included to discover in which

county the respondents were based.

The full survey (i.e. an additional 2103 questionnaires)
was sent out in February 1986, with the questionnaire
colours differentiating the two traffic areas (as in the
pilot survey). Approximately two months later, the
response had slowed to less than a trickle and so a cut off
was used. A total of 497 responses was received, giving a
response rate of 22%. No backup letter was sent, partly
because of time and cost constraints and partly because the
number received was sufficient for statistical analysis.
The results of the survey are given below.

7.3. Results

The purpose of this results section is to investigate
operators' costing behaviour and to discover and model how
costs are determined. This is accomplished by first
considering each of the structural and behavioural
variables in turn and analysing the responses to the
questions relating to these variables. At this stage, the
responses to the introductory questions are analysed and
used to establish the representativeness of the responses.
Second the answers relating to costs and the approaches to
costing are analysed. Third and finally, the two are
combined to determine the influence of the variables on
costs and costing behaviour. Throughout this analysis,
discussion of the results and their implications is kept to
a minimum. A full discussion is given in the following

chapter.

Many statistical tests are used in the following sections
to establish the statistical significance of the results.
The level of significance used throughout is the 5% level.
This implies that there is a 95% certainty the the
relationships described did not occur by chance.

7.3.1. Questions relating to the variables.

Overall, replies were received from 497 operators, 291
(59%) of which were from mainly O/A firms, 200 (40%) from
mainly H/R firms and 6 (1%) from mainly contract hire
firms. This compares with the national breakdown of 66%
O/A operators and 34% H/R operators (CSRGT 1984). The
replies were, therefore, reasonably representative of the
whole population.

Although equal numbers of questionnaires were distributed
to both traffic areas, 56% of the responses were received
from the WTA and 44% from the WMTA. A possible reason for
the higher response rate from the WTA is that operators in
the South West have a greater sense of identification with
Plymouth Polytechnic than operators in the Midlands. It is
also .plausible that operators in the South West receive
fewer questionnaires than those in the Midlands and are,
therefore, more inclined to complete them. The split
between O/A and H/R operators in the two traffic areas is
shown in Table 7.2.

TABLE 7.2

PERCENTAGE OF OPERATORS BY TYPE OF FIRM AND TRAFFIC AREA

	WTA	WMTA	TOTAL
H/R	24	17	41
O/A	32	27	59
TOTAL	56	44	100

Thus, in the WTA, there was more of an even split between O/A and H/R responses, than in the WMTA where proportionately more responses were received from O/A operators.

Structure

The total number of vehicles based at the respondents' depots was 2990 and in the total company fleets, the number was 8410. The latter number is probably the more relevant, since any one company is likely to have approximately the same costing system at every depot in the company. Thus by sampling the costing system of one depot, a much wider coverage is really being achieved. These numbers are probably a considerable underestimation of the total numbers of vehicles based in the sample. A total of 43 respondents left blank the number of vehicles based at the depot and 85 left blank the number of vehicles in the total

company fleets. The reasoning behind this was presumably
that they were unsure of the numbers. It seems likely that
only where the numbers were large, would this occur. The
size of fleet profiles of the respondents are shown in
Table 7.3 along with the size of fleet profiles of the
whole sample.

<u>TABLE 7.3</u>

<u>A COMPARISON OF SIZE OF FLEET PROFILES - PERCENTAGES OF</u>

<u>OPERATORS WITH GIVEN FLEET SIZES</u>

Number of vehicles	1	2-5	6-10	11-20	21-50	51-100	100+
Total sample		69	17	9	3	1	-
Respondents							
Based at depot	18	53	15	8	5	1	-
Total company fleet	15	44	15	10	7	5	4

As expected, companies as a whole have larger fleets than
depots. It is interesting to note that 18% of the returns
stated that they had only one vehicle eventhough operators
with 1 vehicle were excluded from the survey. The
explanation for this is twofold: First, operators may
apply for a licence for more than one vehicle to, say,
cover the peaks in their trade, but at the time the
questionnaire was received, only one vehicle was based at
the depot. Second, within the sample, operators applying
for a licence under the heading "continuation with
modification" were included. Those who had more than one
vehicle but were applying to reduce it to one, would,
therefore, have been included. When the questionnaire was
received, they may have already have made the changes.

The first row of Table 7.3 is arrived at by disregarding the single vehicle operators from Table 7.1 and recalculating the percentages. Table 7.3 shows that a disproportionately low number of replies was received from those operators with 2-5 vehicles, although ,if for the two reasons stated above, the number of respondents with less than 6 vehicles is used as a comparison, the relative proportions are very similar. This shows that there is little response bias by size, except that which was introduced through the exclusion of the operators with one vehicle.

From the fleet breakdown, it can be seen that few operators have more than 10 vehicles. For clarity and ease of analysis, firms were divided into small (less than 6 vehicles), medium (6 to 10 vehicles) and large (more than 10 vehicles). The following points emerged from cross tabulation analysis of the results, using Chi-squared as the test of significance: 1) There was no significant difference in size of fleet between types of operator. 2) As would be expected, regional firms were significantly smaller than national or internation firms, although there was no difference in size between national and international firms. 3) There was no significant difference between the size of firm and the level of perceived competition.

Turning to the geographical base of the respondents, 46% said they considered their firms to be nationally based,

45% said regionally based and 9% said internationally
based. More O/A operators were regionally based than H/R
operators.

Owner management.

Surprisingly, 91% of the respondents said that the owners
of their firm played an active part in its management. Of
the H/R respondents, 98% answered in the affirmative. This
was significantly different from the 88% of O/A operators
who answered in the affirmative.

 Stated Objectives

The perceived stated objectives of the respondents' firms
are shown in Table 7.4 which shows the percentage of
operators who replied that the stated objective was one of
their firm's major objectives. Since most operators stated
that their firm had more than one objective, the 'all
operator' column sums to more than 100.

TABLE 7.4

STATED OBJECTIVES, BY TYPE OF OPERATOR.

percentages

	H/R	O/A	All Operators
Maximise profits	56	62	59
Maximise turnover	14	19	17
Maximise growth	16	27	22
Maximise return on capital (ROC)	28	36	33
Maximise service	68	67	67
Maximise income	28	22	24
Acceptable profits	26	27	27
Acceptable turnover	28	29	29
Acceptable growth	29	30	30
Acceptable ROC	22	23	22
Acceptable service	11	16	14
Acceptable income	27	26	29

The most popular objective was thus to maximise service to customers, with 67% of operators stating this as one of their major objectives. Easily the most popular financial objective was to maximise profits. This appears to go some way towards supporting the neoclassical theory of the firm. However, it is also interesting to note that 27% of operators admitted to seeking only to make an acceptable level of profits. Given that there was likely to be some pressure on respondents to state that the policy of their firm was to maximise, this figure of 27% seems quite high. On two of the objectives, turnover and growth, more operators sought to make an acceptable level than sought to maximise.

There was very little difference between the stated objectives of O/A and H/R respondents. The greatest differences were that H/R operators were slightly less

concerned with maximising growth and ROC. When the
acceptable and maximisise responses are added together,
profits emerged as the most important objective, with
service in second place.

Overall, O/A respondents stated that they had more
objectives than H/R operators.

Competitive Pressure.

Table 7.5 shows the perceived level of success of the firms
over the preceding year.

TABLE 7.5

PERCEIVED LEVEL OF SUCCESS

percentages

	Very Successful	Fairly Successful	Fairly Unsuccessful	Very Unsuccessful
H/R	10	73	13	4
O/A	24	67	7	2
Total	18	69	10	3

A total of 87% of respondents believed their firms to be
successful as opposed to unsuccessful. H/R operators
perceived themselves to be less successful than O/A
operators.

Respondent level of perceived competition is shown in
Table 7.6

TABLE 7.6

LEVEL OF PERCEIVED COMPETITION

percentages

	Extremely Intense	Very Intense	Fairly Intense	Not very Intense	Non Existent
H/R	34	34	21	11	2
O/A	34	34	27	5	-
Total	34	34	24	7	1

As would be expected from the freight literature, the majority of respondents (68%) perceived the level of competition as either 'extremely' or 'very' intense. What is surprising, however, is that a total of 8% of operators viewed the level of competition as either 'not very' intense or 'non-existent'. In the case of H/R operators, this percentage is 13%. A possible explanation for this is that, as was seen in the visits to 18 firms, some firms had specialised (either by product or by customer) to such an extent that actual competition was effectively eliminated.

The third aspect of competitive pressure is the perceived state of the national economy. This is shown in Table 7.7.

TABLE 7.7

STATE OF THE NATIONAL ECONOMY

percentages

	Extremely Healthy	Very Healthy	Fairly Healthy	Fairly Depressed	Very Depressed
H/R	0	3	38	47	12
O/A	0	6	48	38	7
Total	0	5	44	42	9

Thus, most respondents believed the economy to be depressed, with only 5% believing it to be 'very healthy'.

A total of 9% thought it was 'very depressed.' H/R operators viewed the economy as more depressed than O/A operators.

Overall, considering the three measures of competitive pressure, its level was perceived as fairly high; the level of outside competition was viewed as intense and the economy was viewed as depressed. However, despite this, most operators perceived their firms to be successful.

Budgets and Targets.

Overall, 32.7% of respondents said that they had written budgets for transport expenditure. There was a significant difference between the number of O/A respondents using them (43%) and the number of H/R operators using them (18.5%). Behavioural theory puts much stress on the use of budgets, stating that they are widely used precedents for behaviour. Since 67% of respondents stated that budgets were not used, it could be seen as a refutation of the theory. However, 33% is quite a high percentage and when it is considered that 27% of the companies in the survey had only one or two vehicles and furthermore, that many firms probably had unwritten budgets, support for the theory is increased.

Turning to targets, 20% of respondents said that they had written targets for transport objectives; significantly less than the number using budgets. There was very little

difference between H/R and O/A respondents on their use of targets.

Only 14% of operators had both written targets and written budgets, whereas 62% had neither. Although behavioural theory does not state that every firm uses both budgets and targets, this figure is perhaps lower than would be expected from it.

Information Handling

A total of 43% of operators said that they monitored other operator's costs and 61% said that rates of other operators were monitored. Thus, a significantly greater proportion of operators monitored rates than costs. This is to be expected since, for the H/R operators, market competitiveness can only be gauged if other operators' rates are known; since many O/A operators use public hauliers at least occasionally, a knowledge of their rates is important. Thus a knowledge of other operators' rates is of more immediate importance than a knowledge of their costs.

Again using the Chi-squared test of significance and a 5% significance level, there was no significant difference between the percentages of O/A operators and H/R operators monitoring costs. There was, however, a significant difference in the numbers monitoring rates. Whereas 74% of

H/R operators monitored rates, only 51% of O/A operators
did. Although this difference exists, it is quite
surprising that only 74% of H/R operators monitored rates
given the perceived level of competition. Even if
competitors' rates were not taken into account when rate
setting, it would still seem prudent to have some knowledge
of others' rates. Similarly, it is also surprising that
only 43% of operators monitor other operators costs.
Without comparing costs against others in the market, there
is no method of discovering whether costs are being
minimised. Thus, in effect, it is supporting the
behavioural theory that costs are merely being kept at an
acceptable level.

7.3.2 Costing approaches and methods

The proportion of respondents calculating costs is shown in
Table 7.8.

TABLE 7.8

PERCENTAGE OF OPERATORS WHO CALCULATED COSTS.

	YES	NO
H/R	82.9	17.1
O/A	80.8	19.2
Total	81.5	18.5

The striking result to emerge from Table 7.8 is that
nearly 20% of the respondents in this survey stated that
they did not calculate costs. Furthermore, it seems likely
that those replying to the survey would be, if anything,

more likely to calculate costs than those not replying for they may have been embarrassed about their costing systems, too disorganised to reply to the questionnaire and to have any costing system, or may have thought that it was pointless replying if they did no costings. The figure of 20% is, therefore, likely to be, if anything, an underestimation of the proportion of operators not calculating costs. This observation is supportive of the behavioural theory, as costs cannot be minimised if they are not known in the first place.

There was very little difference in the proportion of H/R and O/A operators not calculating costs.

The level of satisficing is not only evidenced by the high number of operators who do not calculate costs, but also by the quality of costing done by those operators who stated that costs were calculated. Table 7.9 shows as an example of the poor quality of the costing, the level of aggregation of costs by type of operator.

TABLE 7.9

LEVEL OF AGGREGATION OF COSTS.

percentages

Type of firm	Individual Vehicle	Weight Category of veh.	Type of Vehicle	Aggregate
H/R	58.9	7.7	10.1	23.2
O/A	50.9	6.8	2.1	39.8

Although there was very little difference in the proportions of O/A and H/R respondents who did not

calculate costs, Table 7.9 demonstrates that H/R operators
tend to calculate their costs in more detail than their O/A
counterparts. Almost 40% of O/A operators doing costings
calculated them on an aggregate basis, whereas this
proportion is reduced to 23% in the H/R case.

Table 7.10 shows the cost elements taken into account and
the frequency of cost calculations of the operators
calculating costs. Because of the error in the pilot
questionnaire, only the responses from the final
questionnaire are included.

TABLE 7.10

COST ELEMENTS TAKEN INTO ACCOUNT BY OPERATORS

Number of operators

	Daily	Weekly	Monthly	Quarterly	Annually	Not at All
Licences	13	22	82	52	205	27
Insurance	14	0	80	47	212	25
Depreciation	8	15	75	49	209	45
Garage Wages	15	52	94	36	81	123
Drivers Wage	24	100	96	44	103	34
Overheads	14	31	121	59	122	54
Vehicle hire	27	18	65	28	57	205
Interest	5	10	83	56	108	139
Inflation	3	6	42	43	132	175
Equipment	10	17	88	50	109	126
Fuel	44	63	159	44	76	15
Oil	27	57	149	43	76	49
Tyres	20	37	150	59	98	37
Maintenance	18	55	157	53	87	31
Accidents	24	18	53	31	125	150

Predictably the most common cost item taken into account was fuel, calculated by 96% of those operators who calculated costs. After fuel the most frequently included cost elements were licences (93%), drivers wages (92%), and maintenance (92%). Inflation and interest were often omitted from the cost frameworks. Garage wages (69%) and vehicle hire (49%) were the least frequently included cost elements. This is understandable since many operators do not do their own repairs nor do they hire in vehicles.

As was found in the survey of 18 firms, many operators calculated the most important costs (in terms of proportion of total costs accounted for by them), but neglected to calculate other costs. Since these other costs were still incurred eventhough they were not calculated, many operators were seriously underestimating costs.

Not only were very few cost elements calculated in many firms, and then only in very aggregate terms, but also they were calculated very infrequently. It was very common for cost elements, especially standing cost elements, to be calculated only on an annual basis. Even running costs, which should ideally be calculated weekly, if not daily, were commonly calculated only monthly, quarterly or annually. The infrequency with which many operators calculated costs, totally precludes operators doing any detailed analysis of the costs of their operations.

In order to compare the level of detail of costing between

sectors or regions, it was necessary to transform the data
from Table 7.10 into a more manageable format. Careful
consideration of the range of individual replies led to the
following level of detail categorisation, with eight
mutually exclusive categories:

(1) All cost elements calculated frequently (i.e. daily,
weekly, or monthly).

(2) All cost elements calculated infrequently (i.e.
quarterly or annually).

(3) Most costs (i.e. at least 8 elements of costs calculated
  frequently.

(4) Most cost elements calculated infrequently.

(5) Most cost elements calculated, but running costs
 more frequently than standing costs.

(6) All costs, but running costs more frequently than
standing costs.

(7) Few costs infrequently

(8) Other.

  Using this categorisation, the most common level of
detail of costing (carried out by 24% of operators who
calculated costs) was that described by category (6) i.e
all costs but running costs more frequently than standing
costs. This was followed by category (2) i.e all costs
calculated infrequently. It is remarkable that only 10% of
respondents who calculated costs, calculated 'all costs
frequently'. This is the same percentage as calculated
'few costs infrequently.'

Considering further the level of detail categories above, a more meaningful categorisation can be obtained by dividing it into two further categories - those categories which constitute good costing practices and those which do not. A good costing practice must encompass both the calculation of a high number of cost elements and a high frequency of calculation. Categories (1), (3), (5) and (6) thus constitute good costing practices.

Using this classification, only 58% of operators who did costings had good costing practices. This is a very low percentage considering the importance of calculating costs accurately. Considering the differences between H/R and O/A operators, again H/R operators have better costing practices. Whereas 65% of H/R operators calculating costs have 'good costing practices', this percentage is reduced to 54% in the O/A sector.

It might be expected that those firms who perceived themselves as successful would have better costing practices than those who perceived themselves as unsuccessful. This, however was not the case, there was virtually no difference between them. Similarly, there was no relationship between the level of perceived competition and the detail of costing. There were, however, three other variables that were linked statistically to the level of detail of costings. The first was whether or not the firms monitored other hauliers' costs, with 66% of those

respondents who monitored costs having good costing practices, compared to 43% of those who do not. The second was that respondents with national or international coverage had better costing practices than those with only regional coverage. The third variable was whether or not budgets were used. Seventy three percent of those operators who used budgets had good costing practices compared with 49% who did not use budgets.

Overall, then, operators seemed not to attach a great deal of importance to costing. Almost 20% of operators did not calculate costs at all and many of the remainder did only very inadequate costings. The methods used were often deficient in terms of the number of cost elements calculated, the level of aggregation of costs and the frequency with which they were calculated.

7.3.3. Costs.

A total of 368 respondents gave costs for the specified journey. The breakdown of costs by GVW is shown in Fig 7.1.

Seven major weight categories were identified in the analysis. A further forty respondents gave costs, but their vehicle weights were unusual (e.g. 26 tonnes) and therefore were not used in the analysis. Fig 7.1 shows, as expected, that mean costs increase with GVW except in the

FIGURE 7.1

OPERATING COSTS BY GROSS VEHICLE WEIGHT

MEAN COST (POUNDS)
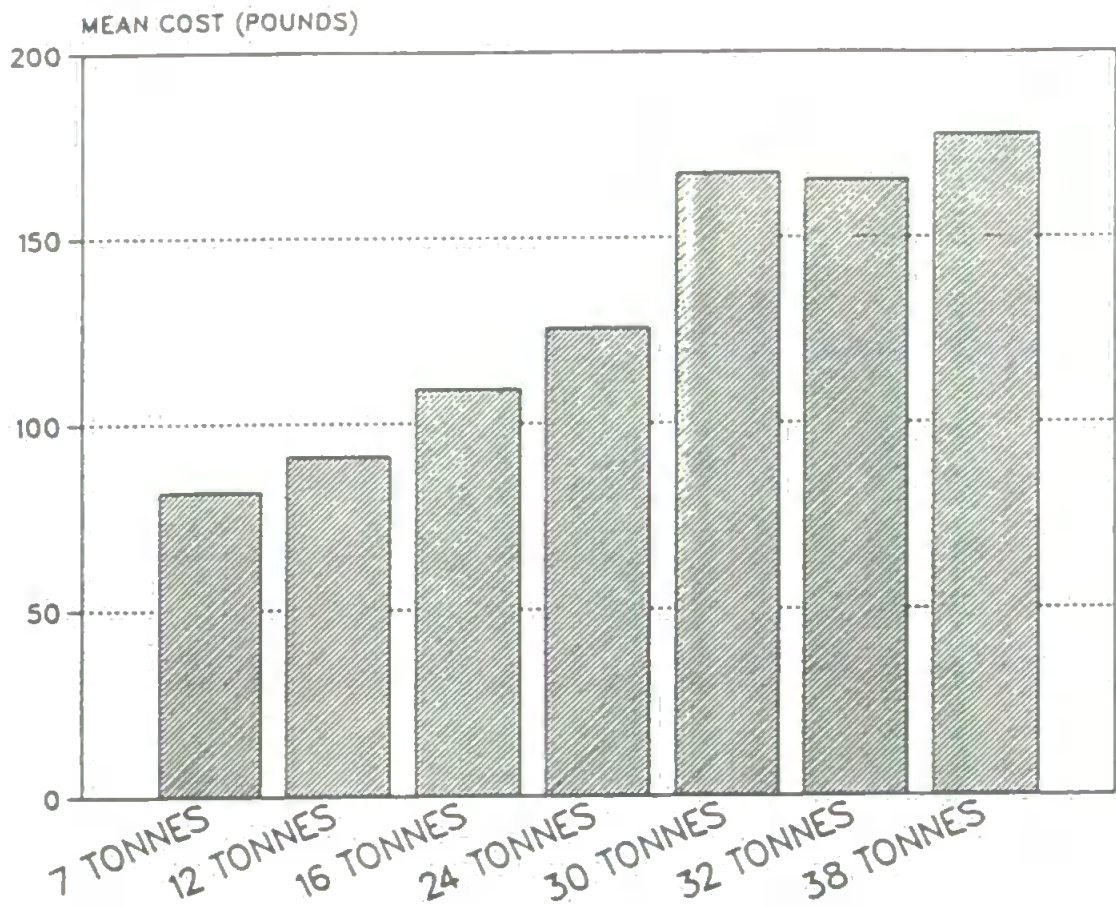
FIGURE 7.2

OPERATING COSTS (POUNDS)

COST/TONNE GVW
COST/TONNE CAPACIT

MEAN COST (POUNDS)
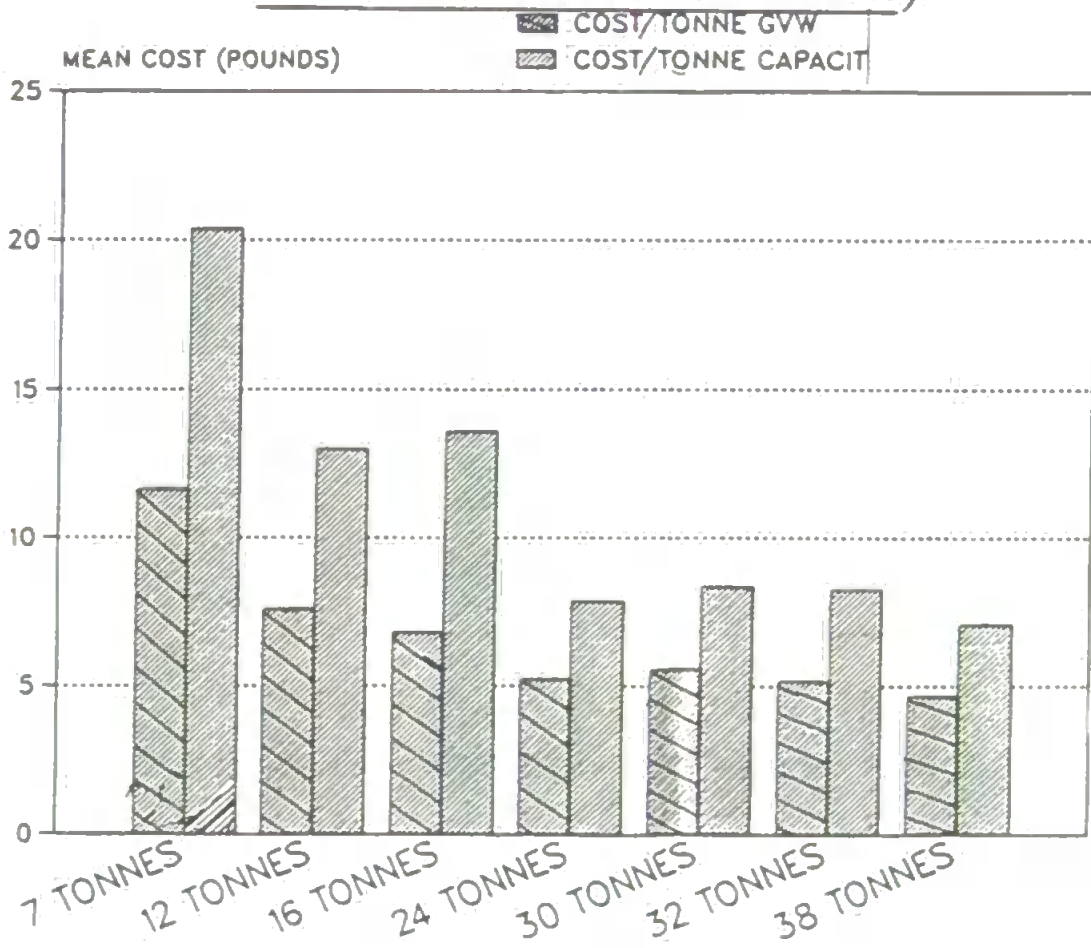
case of the 32 tonne vehicle. In fact it seems more likely that it is the costs for the 30 tonne vehicle which are out of line. Thirty tonne vehicles are likely to be rigid, off-road vehicles which are more expensive to run than the equivalent weight articulated vehicles.

To discover whether economies of scale exist at the level of the individual vehicle, the mean cost must be divided by the carrying capacity of the vehicles. Fig 7.2 shows the mean cost per tonne carrying capacity and the mean cost per tonne GVW. The carrying capacity used is the median capacity for each GVW, obtained from the survey.

Fig 7.2 shows that there are indeed considerable economies of scale to be gained from the use of heavier vehicles. The costs per capacity tonne of a 38 tonne vehicle are nearly a third of the costs per capacity tonne of a 7 tonne vehicle. The economies decrease with increasing GVW. It is interesting to note that the costs per capacity tonne of a 24 tonne vehicle are less than those of a 30 tonne or a 32 tonne vehicle. The cheapest vehicle, overall, according to the survey, is the 38 tonne vehicle.

Considering the variability of costs, as measured by the standard deviation/mean for each GVW, this decreases continuously with increasing GVW. Thus for example, mean costs for the 7 tonne vehicle were £82 and the standard deviation was £43, giving a ratio of .53, whilst for the 38 tonne vehicle, mean costs were £179 and the standard

deviation 54.3, giving a ratio of 0.3. There is, then,
more agreement on the cost of operating heavier vehicles.

Comparison with Published Cost Tables.

The use of published tables of operating costs by
academics and policy makers for evaluation of proposed
projects and policies, was demonstrated in the
Introduction.   To illustrate their unrepresentativeness,
Fig 7.3 compares the costs obtained from the survey against
the costs contained in the published cost tables.   The
latter are calculated using the average annual mileage for
each weight category of vehicle (as shown in the CSRGT
1984).

Fig 7.3 shows that in all cases, published cost tables
give costs which are substantially above those obtained
from the survey.   The difference is greatest in the 16
tonne category, where Commercial Motor (CM) costs are twice
as high as those given in the survey.   The only similarity
occurs in the 32 tonne category where the costs given by
the FTA are virtually the same as those obtained in the
survey.   Thus costs contained in CM and Motor Transport are
totally unrepresentative of the subjective costs of
operators.

Education

FIGURE 7.3

COMPARISON OF OPERATING COSTS OBTAINED FROM THE SURVEY WITH THOSE
CONTAINED IN PUBLISHED COST TABLES.
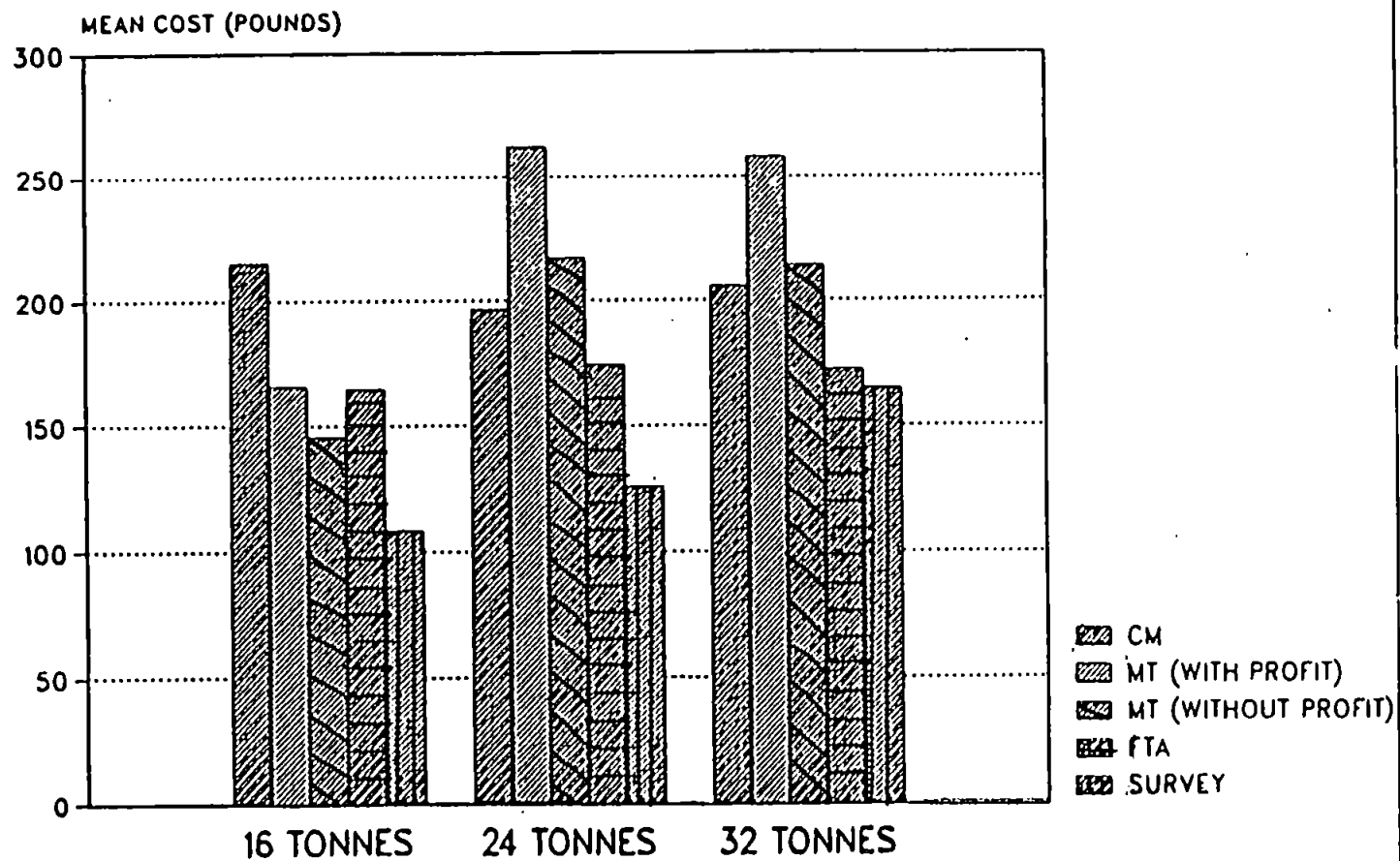
Table 7.11 shows the percentage of respondents with the
stated level of formal educational qualifications.

TABLE 7.11

FORMAL EDUCATIONAL QUALIFICATIONS OF RESPONDENTS.

percentages

	H/R	O/A	Total
none	53.9	28.1	39.0
C.S.E	4.7	2.6	3.5
'O' levels	17.8	30.3	25.0
matriculation	1.1	6.0	3.9
higher school cert.	2.6	5.2	4.1
'A' levels	8.4	11.8	10.4
diploma	2.6	2.6	2.6
H.N.C	2.1	1.5	1.7
degree	6.8	12.2	10.0

A total of 39% of respondents, then, had no formal
qualifications. Only 10% had degrees and a further 10% had
'A' levels. It is noticeable that O/A operators were
better educated than H/R operators.

Differences between regions.

Throughout this chapter, comparisons have been made
between types of operator and it has been shown that there
were many differences in attitudes and practices. When
comparisons between traffic areas are considered, very few
differences are apparent. In fact, the two regions are
remarkably similar in most respects considered: the two
regions have the same level of perceived success, the same
use of budgets and targets, view the level of outside
competition as equally intense, have the same views on the

state of the economy and do costings to the same level of
aggregation and detail. The major differences between
them are that a significantly higher proportion of
respondents in the WTA calculate costs and respondents in
the WMTA are more likely to be part of a larger company
than those from the WTA.

7.3.4. Relating the variables to costs

To this point, the variables and costs have been
considered independently. In order to discover whether and
how costs are determined by the variables, the two must be
related. Consider first the effect of each variable on
costs. The most effective method of doing this is to
consider either absence-presence differences in costs, e.g.
to consider the difference in costs between those who use
budgets and targets and those who do not, or high
presence-low presence differences in costs, e.g. the
difference in costs between those operators who perceive
competition to be intense and those who consider it to be
not so intense.

As in the previous chapter, some of the variables were
covered by several questions to increase the validity of
the results. Some method of combining the questions was
again required. For most of the variables, judgement was
used. For example 'high education' was defined as the
attainment of 'A' levels or above as this is the first

qualification to be obtained if individuals choose to stay
in education.   These respondents may, therefore, be said to
have more of an interest in education and a different
approach to costing.   The following emerged after careful
consideration of the individual replies:

Variable	Procedure used
Information Handling	high = monitor both costs and rates low = any other combination (e.g. do not monitor rates but monitor costs).
Education	high = 'A'levels and above low = below 'A' levels
Competitive pressure	high = company very or fairly unsuccessful or fairly successful + competition extremely or very intense + economy fairly or very depressed low = all other combinations (e.g. company very unsuccessful, competition very intense and economy fairly depressed).

Aspirations were a little more difficult to divide into two
groups using judgement. The aim was to divide the respondents
into one group of high aspirers and one group of low aspirer
Cluster analysis was therefore used to divide the respondents
into two clusters.   The clusters were composed of respondents
with the following features;

	Cluster 1 (258 cases)		Cluster 2 (239 cases)	
	Percentage Occurence	Ratio Occurence	Percentage Occurence	Ratio Occurence
Max profits	72.1	1.21	46.4	0.78
Max turnover	18.2	1.02	17.6	0.98
Max growth	27.9	1.21	18.0	0.78
Max ROC	32.9	0.99	33.9	1.01
Max service	64.3	0.95	72.0	1.06
Max income	26.4	1.03	24.7	0.97
Accept profits	2.3	0.08	54.8	1.99
Accept turnover	10.5	0.35	50.2	1.7
Accept growth	5.8	0.19	56.5	1.87
Accept ROC	6.6	0.29	40.6	1.77
Accept service	3.1	0.21	27.6	1.85
Accept income	6.6	0.24	17.6	1.82

Ratio Occurence = Percentage occurence in cluster/total percentage occurence.

Respondents are thus divided quite reasonably into two groups; one of high aspirers (Cluster 1) and one of low aspirers (Cluster 2). This is shown by the fact that in Cluster 1, most of the maximising objectives have a ratio occurence of more than 1 and most of the satisficing objectives have a ratio occurence of less than 1. The reverse is true of Cluster 2.

Having thus divided the respondents into two groups for each question or variable, the most appropriate measure of cost had to be found. Dividing the costs into weight categories was unsatisfactory because of insufficient numbers in certain weight categories. Costs divided by GVW or capacity would introduce a distortion into the analysis because of the difference in GVW/carrying capacity ratios between vehicles (i.e. the existence of technical economies of scale at the individual vehicle level). Therefore, the following adjustment was made to take

account of this.

Consider a two group case; that of H/R and O/A operators.
Should one group have a disproportionately high number of
small vehicles, costs per tonne capacity would seem higher
for this group. This difference in costs, however, could
not necessarily be attributed to the type of operator as
the difference in vehicle structures of the groups is also
involved. To compensate for this distortion, each vehicle
was converted into a 38 tonne equivalent. For example, the
capacity/GVW ratio for a 38 tonner is 25/38, or 0.658: For
a 16 tonner it is 10/16, or 0.625. To convert a 16 tonner
into a 38 tonner equivalent, therefore, the cost for the
job was divided by 0.658/0.625, or 1.053. This was done
for all weights of vehicle. The adjustment enables the
direct comparison of costs between groups within any one
variable, keeping all other variables constant. The
resulting costs are used in all the following analysis as
'adjusted cost'.

The cost differences between groups for any one variable
are shown in Table 7.12

TABLE 7.12
INFLUENCE OF VARIABLES ON COSTS - 1

Variable	Adjusted cost per tonne of carrying capacity (pence)	Standard deviation	Number in group	Significant at 5% level?
H/R	10.34	7.96	178	NO
O/A	11.54	8.47	210	
International	10.67	7.93	42	
National	11.43	9.88	192	NO
Regional	10.54	5.77	152	
Owner managed	10.98	8.44	354	NO
non owner managed	11.22	6.01	33	
Use budgets	11.19	8.5	127	NO
No budgets	10.9	8.16	260	
Do costings	11.16	8.56	313	NO
No costings	10.11	6.62	65	
WTA	11.25	9.12	212	NO
WMTA	10.67	7.08	176	
High aspirers	10.73	7.96	200	NO
Low aspirers	11.26	8.57	188	
High Education	11.20	8.9	98	NO
Low education	10.96	8.18	274	
High competition	11.03	7.94	263	NO
Low competition	10.89	9.09	112	
High information handling	10.89	8.63	146	NO
Low information handling	11.11	8.08	228	
Small	11.26	7.66	255	
Medium	10.07	10.5	59	NO
Large	9.49	2.99	53	

The appropriate statistical test for determining whether there is a significant difference between the mean costs of the two groups within any one variable, is the Two Sample T-Test. Using this test, none of the variables emerged as significant. The size of the firm had a significant

influence in that large firms had lower costs than smaller
firms.   However, large firms' costs were not significantly
different from medium sized firms' costs which in turn were
not significantly different from small firms' costs. The
difference in costs between many groups was surprisingly
small suggesting that the variable to which the groups
belonged, had very little influence on costs.   This was
particularly true of competitive pressure and information
handling.

 The standard deviations give an indication of the
variation in costs for any one particular group.   In most
cases the standard deviations are quite high suggesting
that there is not a great deal of agreement on costs
between firms.   The group which showed the highest level of
agreement was respondents from large firms where the mean
cost/tonne capacity was £9.49 and the standard deviation
was only £2.99.   At the other end of the spectrum, those
firms who consider themselves to be unsuccesful had an
average cost of £12 and a standard deviation of £12.7.

To investigate further the relationship between the
variables and costs, the respondents were divided into
three groups; those with relatively high costs (i.e.
adjusted costs exceeding £10 per tonne capacity), those
with low costs (i.e. adjusted costs below £7.5 per tonne
capacity, and those with medium costs (i.e. the remainder).
The relationships are shown in Table 7.13.

TABLE 7.13

INFLUENCE OF VARIABLES ON COSTS - 2

percentages

Variable	Low cost Group	Medium cost Group	High cost Group
H/R	38	34	28
O/A	28	32	39
Owner managed	33	33	34
Non owner managed	27	33	39
WTA	31	34	35
WMTA	35	32	33
Small	36	29	36
Medium	28	52	20
Large	26	36	38
High aspirers	29	31	32
Low aspirers	32	35	36
High competition	36	34	35
Low competition	28	30	34
High education	28	39	33
Low education	34	32	34
High information handling	33	38	29
Low information handling	32	30	38
Do costings	30	35	35
No costings	55	27	18
International	30	43	27
National	30	39	31
Regional	38	23	39

This form of analysis indicates that three of the variables (O/A-H/R, whether or not costings are done and the size of the firm), have a noticeable influence on costs. There was a higher percentage of O/A operators in the 'high cost' group and a correspondingly lower percentage in the 'low cost' group. O/A operators tended, therefore, to have higher costs than H/R operators. This

is consisitent with the group analysis of Table 7.12. Similarly, a higher percentage of operators who calculated costs were in the 'high cost' group and a correspondingly lower percentage were in the 'low cost' group indicating that those operators who calculated costs had higher costs than those who did not. This again conforms with the group analysis in Table 7.12. Finally, larger firms had higher costs than smaller firms. This goes against the analysis in Table 7.12.

In order to investigate and model how costs are determined, the combined influence of the variables and their relative strengths must be considered. To this end, multiple regression was used.

Data on the structural and behavioural variables was entered in a combination of binary and numerical forms, as shown in Equation 1. In addition to the original variables under scrutiny, other variables, (such as whether or not firms did costings), the importance of which emerged subsequent to the original analysis, were also entered. Furthermore, the classification of the groups within the variables were changed in order to obtain the 'best' relationship (judged in terms of the coefficient of multiple determination, R^2, and the variable coefficient T ratios), allowing sensitivity analysis to be performed. For example, with aspirations, the regression analysis was first performed using output from the cluster analysis (shown above) to classify the respondents into high or low

aspirers. As there was some degree of overlap in these groups (i.e. some operators who stated that they maximised profits were classified as low aspirers), an alternative classification was used whereby any operator who stated that they sought to maximise either profits or ROC was classified as a high aspirer, and vice versa.

The full results of the regression analysis are shown in Appendix 7a. The equation was as follows:

Equation 1

Adjusted = 35.4 + 14.2a - 7.24b + 6.54c + 0.78d -
Cost
         0.11e + 1.07f - 4.25g - 2.60h + 15.8i

         + 14.8j + 3.67k + 9.15l

R^2 = 61% or 59.4% adjusted for degrees of freedom.
No. of observations = 313

where:

Variable	Meaning	Method of Operationalisation	Coeffi-cient	T ratio
constant			35.36	3.64
a	Type of operator	1 = H/R 0 = O/A	14.18	3.231
b	Owner managed?	1 = yes 0 = no	-7.24	-0.94
c	Area	1 = WTA 0 = WMTA	6.54	1.68
d	Size	no/ vehs in depot	0.78	4.24
e	Aspirations	1 = high 0 = low	-0.11	0.03
f	Competition	1 = high 0 = low	1.07	0.26
g	Education	1 = high 0 = low	-4.52	-1.05
h	Info Handling	1 = high 0 = low	-2.6	-0.65
i	Do costings?	1 = yes 0 = no	15.8	3.07
j	Geographical coverage	1 = national or international		
		0 = regional	14.8	3.59
k	Capacity of vehicle	tonnes	3.67	12.04
l	Budgets done?	1 = yes 0 = no	9.15	1.95

This equation, along with the summary statistics, emerged only after the elimination of 15 outlying observations.

The elimination criterion used was that any observation with a standardised residual exceeding 2.5 was removed as these observations have a disproportionately large influence on the analysis (Lewis-Beck 1980). In a normal distribution, only 5% of the standardised residuals would lie more than 1.96 standard deviations from the mean. In this particular study, the percentage was approximately 8%. The standardised residuals were, therefore, very close to being normally distributed (demonstrating the validity of the results).

Analysis of the 15 outlying observations showed that there were no underlying patterns in the data; each appeared to have a different reason for so being.

From this analysis, five variables (a,d,i,j,k) and the constant were significant at the 5% level (T ratio $>$1.96) suggesting that they have a significant influence on costs. An F test on the value of R^2 showed that an R^2 of 59.4%, adjusted for degrees of freedom, is highly significant. Thus 59.4% of the variation in adjusted cost is explained by the variables included in the equation. Of the significant variables, by far the most important variable, accounting for 32% of the explained sum of squares of the regression was the carrying capacity of the vehicle. The type of firm accounted for a further 22%, size accounted for 20%, and geographical coverage accounted for a further 10%. The other variable which had a noticeable effect on

costs in the previous two forms of analysis; whether or not costings were done, accounted for only 8%.

As Chatterjee and Price (1977) say "an important goal in regression analysis is to arrive at adequate descriptions of observed phenomenon in terms of as few variables as possible." Parsimony enables the isolation of the most important variables whilst maintaining simplicity and ease of understanding.

One method of eliminating the unimportant variables is to use stepwise regression analysis. Stepwise regression enters the variable with the highest correlation with the dependent variable first and then goes on to enter the variable with the highest correlation with the dependent variable after the latter has been adjusted for the effect of the first variable. This continues until there are no more significantly correlated variables to enter. The criterion of significance used was that the F value exceeded 1.99.

As would be expected, a stepwise regression using all the variables enters variables a,d,i,j,k,l giving Equation 2 where the figures in brackets are T ratios. The full output is shown in Appendix 7b.

Equation 2

Adjusted = 30.41 + 3.63k + 0.75d + 14.5j + 17.0i
Cost   (12.14) (4.17) (3.56) (3.39)   (3.47)

          + 14.5a + 10.01
            (3.47)   (2.23)
R^2 = 60.34%

Equation 2 includes variable 1, use of budgets, which was
slightly below the significance level in Equation 1. This
change occurs because in Equation 1 it reacts slightly with
other variables not included in Equation 2. The discussion
below shows that the reaction is insufficient, however, to
distort the analysis.

The coefficients have the same sign and are of virtually
the same magnitude as their corresponding coefficients in
Equation 1. The difference in R^2 between the two equations
shows that the reduced equation (using the stepwise
regression) loses only 0.66% of the explanatory power of
the full equation. Performing an F test using the full and
reduced equations confirms that there is no statistical
difference in the explanatory powers of the two equations.
The reduced equation is, therefore, the 'best' equation.

In order to test for any model deficiencies, the
standardised residuals were plotted against each of the
independent variables. These plots are shown in Appendix
7c. The standardised residuals of an appropriate model
would be approximately randomly distributed about 0 and
should fall between -2 and +2 (Chatterjee and Price

1977, Kleinbaum and Kupper 1978). Any obvious patterns are an indication of model violation. Appendix 5b shows that there are no such patterns.

Probably the most likely problem in this study would be multicollinearity. Although this should show up in the residual plots, a further test is to calculate a correlation matrix between all the variables. Correlation coefficients exceeding 0.8 indicate the possible presence of multicollinearity (Lewis-Beck 1980). The correlation matrix shown in Appendix 7d shows that none of the coefficients exceed this value and that most of them are very low. Multicollinearity, therefore, should not be a problem. Since the residual plots show no patterns and there are no other signs of model deficiencies, it can be assumed that the model is appropriate.

The Durbin-Watson statistic of 1.94 indicates that autocorrelation is not a problem.

The stepwise regression, then, suggests the inclusion of six variables and a constant. The variables were vehicle carrying capacity, type of firm, size of depot, geographical coverage, whether or not costings were done and use of budgets. The signs of the coefficients demonstrate that adjusted costs increase with the capacity of the vehicle and the size of the depot (in terms of numbers of vehicles), and increase further if the firm is H/R (as opposed to O/A), is national or international in

coverage (as opposed to regional) calculates its costs and uses budgets.

An important result emerging from the analysis is that only one of the behavioural variables (use of budgets) had a significant influence on costs and this variable was barely significant. The other behavioural variables were, in fact, far from being even close to significant. The highest T ratio obtained for the other behavioural variables was 0.65, for information handling. The T ratio for aspirations was as low as 0.03. This analysis suggests then, that the behavioural variables explain practically none of the variation in costs.

Some very important and interesting results have emerged from this chapter. A discussion of these and the other results of this research is the subject of the next chapter.

CHAPTER 8

DISCUSSION AND CONCLUSIONS

8.1 Introduction

This thesis started by illustrating the importance of the industry to both the national economy and society. It was stated that because of its importance and widespread effects, it is vital that there exists a thorough knowledge and understanding of its costs. One of the fundamental themes of the thesis has been that for many policy decisions, it is not the actual costs of transport that are so much of importance but more operators' perceptions of costs. It is operators' perceptions of costs which determine their behaviour, their reactions to changes in legislation and which, therefore, determine the actual outcome of any policy decisions. Using the example of the introduction of the 38 tonne vehicle, it was shown that the consequences of its introduction depend on its usage. This is turn depends on operators' perceptions of its relative merits compared to, say, the 32.5 tonne vehicle. Thus it was a knowledge of operators' whole approaches to costing and their perceived costs which were important. It was stated that little was known of these aspects.

Chapter 2 showed that the current methods of enumerating costs were inadequate for they were almost invariably based on inaccurate and unrepresentative published tables of

costs which did not detail their sources of information.
Since costs were often the major criterion of policy
evaluation, policies which affect practically everyone in
the country were based on unjustifiable foundations.

The aims of this project were, therefore, to investigate
operators' costing and to a lesser extent, pricing,
behaviour to fill some of the gaps that previously existed.
This would enable more realistic evaluations of the likely
outcomes of policy decisions.

In order to consider the determination of costs and
costing behaviour, a theory was required to indicate which
variables were likely to have a determining influence. The
theory which seemed most appropriate to the transport
industry was behavioural theory.

The aim of this final chapter is to bring together the
findings of the empirical studies and to discuss them in
terms of the original objectives of the thesis and the
behavioural theory.

The chapter starts by considering operators' approaches to
costing and pricing and their determination. It goes on to
look at operators' perceived costs and discuss them in
relation to the structural and behavioural variables. The
implications of the research carried out in this thesis are
then discussed. The final section considers the potential
for further research.

8.2. Approaches to costing.

The introduction to this thesis showed that it is usually assumed by academics and legislators that operators will make rational decisions when faced with changes in legislation, based on careful consideration of the full costs of their operations. It was shown that the arguments that foreshadowed the introduction of the 38 tonne vehicle centred around the financial consequences. Policy makers assumed that following the legislation allowing heavier vehicles, operators would rationally weigh up their advantages and use them selectively. In the case of the heavy lorry bans in London, it was assumed that operators would make rationally efficient decisions about which vehicles to use and how to compensate for the restrictions.

Results from the large scale survey showed that almost 20% of operators do not calculate costs at all and are, therefore, likely to have little idea of their operating costs. As stated in chapter 7, this percentage is likely, if anything, to be an underestimation of the actual percentage of operators who do not calculate costs, for those operators may have been embarrassed to admit it and would not, therefore, have replied. Alternatively, they may have considered it pointless returning the questionnaire.

The results further showed that many of those operators who calculated costs did so only very scantily; they calculated only the basic costs (e.g. fuel, wages and maintenance), calculated them only in very aggregate terms (e.g. costs of all vehicles together, or costs per weight category of vehicle), and did so very infrequently (e.g. only monthly or quarterly). It was shown, for instance, that only 41% of respondents who calculated costs, did so on a per vehicle basis. When the number of cost elements taken into account and the frequency of calculation are combined, only 58% of operators who calculated costs, or 47% of total respondents, had good costing practices (i.e. calculated at least 8 cost elements, at least monthly). The majority of operators did very poor costings and, therefore, could not make rational decisions based on their costs.

The same situation was found to be true of the 18 firms visited. Furthermore, it was also discovered during the course of this study, that many operators did not even attach much importance to costing. Reasons for this differed between O/A and H/R operators. The O/A operators perceived the most important aspect of their work was to provide a service to the manufacturing side of the business, practically irrespective of costs. Calculating costs to any degree of detail was perceived, therefore, as unnecessary. H/R operators, on the other hand, proferred two main reasons; the first was that they believed their fleets to be sufficiently small to know the costs of

operating without explicitly calculating them. The second was that they believed the market dictated rates which they had to accept in order to survive. Calculation of detailed costs was perceived, therefore, as a time-consuming waste of effort. This was accentuated by the fact that most of the H/R firms relied to a large extent on contract work which they considered had to be done, again, practically irrespective of costs. Whilst it is important to offer a good service, it must be recognised that it is equally important to know the cost of providing the service so that the most appropriate level can be offered.

Results from the large scale survey showed that the level of detail of costing was dependent on the type of firm. Although the percentage of operators who did not calculate costs was the same between types of firm, H/R operators calculated costs in much greater detail. They aggregated costs to a much lesser degree, calculated more cost elements and did so more frequently.

Again this conforms with the results obtained in the in-depth study of 18 firms. One explanation why H/R operators do better costings is that it is more important for H/R operators to know their costs accurately. Unlike the O/A operators, transport often provided the sole source of income for the H/R operators. The prosperity of the company, therefore, depended on the fortunes of the transport work. The principal money spinner in the O/A firms was the manufacturing/service side of the company:

transport merely supported this.

Overall, H/R operators appeared to be much more alert to
the pressures of business than their O/A counterparts.
This is reflected in the fact that the H/R operators tended
to perceive competitive pressure as being more intense than
the O/A operators. The main sources of pressure on the O/A
operators were internal i.e. pressure from immediate
supervisors. External pressure was more remote. The
contrary was true for the H/R operators. This explains why
H/R operators were more likely to monitor other operators'
costs and rates and relied on more reliable and immediate
sources for this information. O/A operators depended more
on sources such as trade magazines as these were sufficient
to prove to the next level in the hierarchy that their
performance was good.

Economic efficiency was, therefore, more of a driving
force in the H/R sector than in the O/A sector. The
corollary of this is that H/R operators are more likely
then O/A operators to consider the financial implications
of any legislative change.

Three other variables were significant in determining the
level of detail of costs calculated. These were
information handling, use of budgets and geographical
coverage. Those operators who monitored other operators'
costs and rates, those who used budgets and those who had

either national or international coverage had better
costing practices than those operators who did not monitor
costs and rates, those who did not use budgets and those
operators who were only regionally based. One possible
explanation for this is that the former set are the more
business oriented or ambitious operators who recognise the
advantages of doing accurate costings. It could be argued
that the fact that costs were calculated thoroughly has
contributed to the success of such firms, allowing them to
expand into national or international markets.

Perhaps as important as the variables that are related to
the level of detail of costs calculated, are the variables
which have no influence. One such variable is the level of
perceived competition. It was expected that those
operators who perceived competition to be intense would
have better costing approaches than those who did not
because they had more need to calculate costs. This was
not the case. This perhaps illustrates the lack of
importance attached to costing as a whole. The on site
visits to the 18 firms demonstrated that the intensity of
competition was not necessarily combatted through attention
to costs but through attention to service. The prevailing
belief was that markets were won or lost not on costs or
rates, but on the service provided to customers. Another
possible explanation is that many of the firms that view
competitive pressure as intense are those firms where costs
are not kept under control because they have inadequate
costing methods.

Thus, despite the importance of calculating costs accurately, it has been shown that in general operators do very poor costings and furthermore they attach little importance to costs in their decision making. H/R operators did better costings than O/A operators, nationally or internationally based operators did better costings than regionally based operators, those who used budgets had better costing practices than those who did not and operators who monitored others' costs and rates had better costing practices than those who did not. The inadequacy of the costing procedures used implies that operators cannot make rational decisions based on their costs.

8.3. Costs and their determination

As stated in the introduction, the costs of any transport project are usually evaluated using actual, or what are assumed to be actual, costs. Little, if any, attention is paid to operators' perceptions of costs, even though it is these which determine behaviour. One of the objectives of this thesis was to investigate perceived costs and their determination.

This study has shown that six variables explain a very significant proportion of the total variation in perceived

costs. The six variables were: the carrying capacity of the vehicle, size of the depot (in terms of numbers of vehicles based at the depot), geographical base (national, international or regional), whether or not costings were done, whether or not budgets were used and the type of firm (O/A or H/R). Together these variables explained 60% of the total variation in costs using multiple regression analysis. The most influential variable was the carrying capacity of the vehicle (which accounted for 32% of the total variation). The type of firm and the size of the firm accounted for a further 44%.

Despite the fact that H/R operators did better costings than O/A operators, the former had the higher perceived costs. The most likely explanation for this is probably the same as the explanation for the fact that operators who calculate costs have higher perceived costs than those who do not. That is, that rather than actually having lower costs, O/A operators and those who do no costings are duping themselves. They consider their costs to be lower only because they do not know their full costs. It could be argued that those operators who do no costings have lower costs because no expenditure is made on the calculation of costs i.e. nobody is employed to calculate costs. This, however, seems improbable.

Operators who use budgets have higher perceived costs than those who do not. There appears to be two possible explanations for this finding. The first is that as was

shown in the study of 18 firms, although one of the purposes of using a budget is to control expenditure, it was often viewed more as an allocation of resources which had to be used. If budgets were underspent the penalty was a lower budget the following year. Budgets. therefore, tended to encourage spending and increase costs. The second explanation is that the use of budgets signifies good business acumen and that those operators who did not use budgets, like those who did not calculate costs, did their costs less accurately than those who did not. This was illustrated to be so in chapter 6. Thus again, operators who did not use budgets were misleading themselves as to the real magnitude of their costs.

According to the regression model, perceived costs increase with the number of vehicles based at the depot. Also national or international firms have higher perceived costs than regional firms. These two relationships suggest that there are diseconomies of scale in the road freight transport industry. It was shown in Chapter 7, however, that international or national firms have better costing approaches than regional firms. Once again, therefore, it is possible that rather than having lower costs, regional firms may be duping themselves into believing that their costs are lower because they do not know their costs accurately. The truth probably lies somewhere between the two.

One of the important findings to emerge from the analysis

is that the geographical area in which the respondents were based had an insignificant effect on both costs and costing behaviour. In fact the two areas (the South West and the West Midlands) were remarkably similar in most respects. As two contrasting areas were chosen for analysis, the fact that there is little difference between them probably means that operators throughout the country act in similar ways and that the analysis in this thesis is nationally applicable.

Chapter 4 of this thesis proposed that the behavioural theory of the firm provided a good description of the costing and pricing behaviour of operators. The theory was, therefore, used as a basis for this thesis.

In the empirical studies carried out, operators' costing and pricing methods and approaches showed considerable support for the theory. Chapter 4 showed that there was a great deal of general support: operators were shown not to be seeking to maximise profits (they did not even know their costs let alone seek to minimise them); they did a great deal of satisficing (e.g. they used traditional methods of operating rather than weighing up all the possible alternatives to find the 'best' one); much of their behaviour was governed by standard operating procedures and was completely routinised; members of the firm had their own strict routines and concerns and any information entering the firm which did not fit into any one individual's remit was ignored; much of the information

collected was for collection sake and was never utilised; they sought to negotiate the environment through the use of long term contracts, specialisation and by establishing a good name for themselves by joining trade associations. Although the operators all operated in different ways, each of them was acting intendedly rationally - each believed that their way of operating was better than that of anyone else.

Chapter 6 showed that costs and rates differed significantly between operators and that reactions to changes in demand and supply conditions also differed between firms. This is again supportive of the behavioural theory.

In the large scale statistical study it was shown that many operators admitted to seeking only to make an acceptable level of profits, made use of budgets and targets and sought to monitor other operators' costs and rates.

Based on the support for the theory and the on-site observations, five behavioural variables (information handling, competitive pressure, stated goals, performance monitoring and use of budgets and targets) and 3 structural variables (structure, management structure and education,) were proposed as determinants of costs. Chapters 6 and 7 sought to discover whether there was any statistical support for this model and thus to show how costs were determined.

Data from the large scale survey, however, showed that despite the support for behavioural theory on a general level, there was very little statistical evidence that the behavioural variables had any determining influence on costs. The only variable that emerged as significant was whether or not budgets were used, and this was only barely significant. In the regression analysis, most of the behavioural variables had a very low T-statistic attached to them and when they were omitted from the equation, an insignificant proportion of the total explanatory power was removed.

The fact that the behavioural variables were not significant, however, does not imply that the results do not support the behavioural theory. Testing the behavioural theory was not the purpose of this exercise. What it does suggest is that it is difficult to incorporate the behavioural theory into a quantitative model to explain the determination of perceived costs. It is often considered that case study research is the only real method of testing the behavioural theory. In this project, the on-site observations, which can be regarded as mini case studies, did indeed support the theory. All that can really be said is that the variables, which appeared from the behavioural theory as if they would have some determining influence on perceived costs, did not prove significant in the statistical analysis in this project.

8.4. Implications of the research

8.4.1. Implications for operators

The bankruptcy rate of road haulage companies is second only to that of building contractors (Keynote, 1984). It is often assumed that the explanation for this is the extreme competitiveness of the industry. It is clear, however, from the research carried out in this thesis, that a very important contributory factor is that operators pay insufficent attention to the financial side of their businesses, whilst perhaps focussing too heavily on the operational side. Because costs are not calculated in sufficient detail, operators believe that their rates are covering costs. When it comes to, say, making a major repair on a vehicle or purchasing a new vehicle, insufficient money is available and the result is bankruptcy.

This research strongly indicates that those who do less detailed costings perceived their costs to be lower than those who do more detailed costings. It was also shown that operators who do no costings have lower perceived costs than those who do costings. Thus it appears that operators who do not know their costs underestimate their true magnitude. It is these operators who are probably most susceptible to bankruptcy.

272

In the survey of 18 firms, two of the H/R operators did no
costings. Since one of the operators had been operating
for the best part of a century it could be argued that
costing is not important. The main reason for their
survival was, however, their good relationship with one
particular customer. As was observed in another of the
firms visited, this can turn sour with amazing speed
because, for instance, of a change in the management in the
customer's firm. If this occurs, a knowledge of costs is
vital if the business is to be rebuilt successfully.

It is not solely the avoidance of bankruptcy that is
important. Sixty percent of the operators in the large
scale survey stated that profit maximisation was a major
goal of their firm. Profit maximisation cannot be achieved
without an accurate knowledge of costs. Service could well
be the most effective method of maintaining customer
loyalty. Service, however, is a means to an end not an end
in itself. The costs of providing alternative levels of
service should be carefully considered so that the most
appropriate level can be offered.

It is clear, therefore, that the implications for
operators of not doing detailed costings are potentially
devastating and that much more attention should be paid by
most operators to this side of the business.

7.4.2. Implications for academics and legislators.

273

It was shown in Chapter 2 that published tables of operating costs were almost invariably used by academics and legislators for the purpose of operating cost enumerations. The problems associated with this were also illustrated in Chapter 2 using the example of the introduction of the 38 tonne vehicle, where it was shown that its economic viability was dependent on which particular set of tables was used. This research has shown that the two main commercial cost tables (Commercial Motor (CM) and Motor Transport(MT)) are unrepresentative of operators' perceived costs. The large scale survey showed that CM and MT costs were very much higher than those costs obtained from the survey, for all weight categories. In many cases they were twice as high, though the proportionate differences between the cost tables and the survey results varied between weight categories. This makes matters worse; if the published tables overestimated costs consistently across weight categories, at least this would be easily compensated for. Much doubt must therefore be cast on the appropriateness of the conclusions reached by all those who use these sources as a basis of evaluation.

The underlying basis of this thesis is that it is operators' perceived costs and approaches to costing that are of primary importance as it is these that determine behaviour and thus the ultimate outcome of any policy decision. The results of the research on these areas cast

further doubt on the validity of the conclusions reached in the reports of many academics and public bodies. This is perhaps best illustrated again by recourse to the example of the 38 tonner.

The 38 tonne vehicle was introduced on the assumption that operators would behave rationally and that substantial financial savings would result. Results from the large scale survey showed that operators indeed perceived the 38 tonner to be economically viable. Costs per tonne of carrying capacity were lower for the 38 tonner than for any other weight category of vehicle. This explains why as many respondents had 38 tonners as had 32 tonners.

Given the inadquacy of the costing methods used by most operators and the lack of importance attached to costs in the decision making process, it would be practically impossible, however, for operators to make rational decisions on the financial viability of the 38 tonner, on cost grounds. As stated earlier, the usage of the 38 tonner depends on the numbers purchased or converted and the use to which they are put following their purchase. The in-depth study indicated that the two principal reasons for their purchase were to facilitate the operational side of the business (O/A operators) and to maximise flexibility (H/R operators). Financial considerations were secondary. Once the vehicles had been purchased, they had to be used irrespective of their suitability for the job. This meant that they were frequently being used where lighter vehicles

would have sufficed.

The overall economic viability of the 38 tonne vehicle is, therefore, highly debatable. The results of the large scale survey suggest that economic viability would be considered most intensely by H/R operators, operators who are nationally or internationally based, operators who use budgets and who monitor other operators' costs and rates.

From this example it is clear that in order to make justifiable and accurate decisions in policy evaluations, operators' perceived costs and the importance attached to costing must be fully considered. The problem is that it is difficult to take account of costing approaches in a structured way; it cannot easily be built into models. This does not imply, however, that it should be completely neglected. It implies that more study into this particular problem is required. Obtaining perceived costs for different weight categories of vehicles, on the other hand, should be a relatively easy task. They could, for instance, be sought on the same questionnaire sent out by the Department of Transport to estimate the usage of vehicles.

8.5. Scope for further research

The research in this thesis has exposed the need for much further research in the areas covered and associated areas.

It is these which are now considered.

The research in this thesis has shown that operators'
approaches to costing are of paramount importance in the
evaluation of transport issues. Throughout the thesis it
has been shown that operators have a wide range of
approaches, ranging from the non-existent to the fairly
elaborate. Four variables were shown to influence the
level of detail of costing done.

Six variables were shown to be significant determinants of
perceived costs, together explaining 60% of the total
variation. It was hypothesised in chapter 7 that the level
of detail of costing may have been the underlying
determining factor in all of the variables except the
carrying capacity of the vehicle. Because of time
constraints, however, this was not fully investigated. For
policy evaluations, the costing approaches of operators
must somehow be modelled. This would be an important
advance.

The aim of this study was to investigate operators'
approaches to costing and rate setting. In the event, the
investigation of pricing behaviour was only partially
considered. The determination of prices and their
relationship to costs would be a useful area of further
study.

The costs of road freight transport in this study referred only to the movement costs (i.e. operating costs in their strictest sense). Movement costs are, however, only part of the total distribution costs. Throughout this thesis, the economic viability of the 38 tonne vehicle has been used as an illustrative example. It was, however, considered only in terms of its relative operating costs. It is quite possible that its introduction has had repercussions throughout the whole distribution process which should also be taken into account. It could in some cases, for example, obviate the need for regional depots. Expansion of the research in this thesis to cover the whole distribution process would, therefore, afford a more detailed understanding of operators' decision making processes.

Finally, it would be instructive to determine the relationship between actual and perceived costs in the road freight transport industry and to investigate whether the behavioural variables used in this thesis had any determining influence on actual costs. This would, however be a very difficult task as actual costs are very difficult to enumerate since they are so dependent on the methods used to collate them.

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WORKING PAPER - HALLETT AND GRAY

OPERATING COSTS OF HEAVY GOODS VEHICLES IN THE U.K.

1. INTRODUCTION

The road haulage industry in the U.K. is huge, expenditure on it amounting to some £18,500m in 1982. However, despite the obvious need for efficiency in such an industry, knowledge of the magnitude and structure of vehicle operating costs is at a surprisingly elementary level. The implications of this are by no means trivial, for without an accurate knowledge of operating costs, the possibility of analysing fully the likely consequences of legislation affecting the road haulage industry is rendered very limited. The aim of this working paper, therefore, is to review the existing body of knowledge on vehicle operating costs and to highlight its inadequacies.

The paper starts with a critical analysis of some of the published tables of operating costs, including comparisons of the factors included and the relative magnitudes of the costs involved. Particular attention is paid to the generalised nature of the costs included and the implications of this for the practical relevance of such tables. One of the major criticisms is in treatment of capacity utilisation which is either non-existent or incorrect.

Particular attention is paid to the extent to which cost tables are used by academics and in major published reports or inquiries. The consequences of the ignorance surrounding operating costs is discussed in relation to the introduction of the heavier lorry. It is shown, for instance, that the economic viability of the heavier lorry is dependent on the source of operating costs used and the assumptions made about costs relative to capacity utilisation.

The second part of the paper presents the results of an empirical study of the approaches to costing adopted by eighteen heavy goods vehicle operators (nine hire or reward and nine own account), in the south west of England. It demonstrates the use made of published tables of operating costs by transport providers and their opinions of them, and compares the actual cost items taken into account by the different firms in the sample and gives the reasons for the non-use of costs by certain operators. It is shown that it is not just the elements included which differ but the method of allocating fixed costs between vehicles, the amount of detail in the costing framework and the reasons for doing costings. One particular cost element, depreciation, is considered in some detail to show the variations in methods used to calculate this one item. Comparisons are made between the methods used by hire or reward operators and own account operators in relation to the costing procedures used.

Finally, there is a discussion of some of the important issues raised in the paper.

2. PUBLISHED COST TABLES

2.1 Differences between published cost tables

Costing involves the 'process of identifying, calculating and recording every item of expenditure incurred in the purchase or hire of goods vehicles, in maintaining them, in running them and in supporting the administrative and management functions necessary to control their use, followed by an analysis of the total operating costs into costs per unit of load, distance or time'. (Lowe, 1983). The private costs of freight transportation, i.e. the costs borne by the operator, fall into two principal categories: the movement costs and the terminal costs (Button and Pearman, 1981). Movement costs, as the term suggests, are those costs incurred in the actual transportation of the freight on the lorry to its destination point. Movement costs are usually divided into two groups, running costs and standing costs. Running costs are those costs which vary with mileage, whilst standing costs, or fixed costs, are those which are not related to mileage, but are time related. Roudier (1976) further sub-divides running costs into costs which vary as a function of (a) extraneous factors such as the general traffic speeds and the distribution of consignees' premises, and (b) internal factors such as the type of vehicle, the load factors and the composition of the fleet. The first group of costs are often ignored, or at least, assumed to be constant due to difficulties in modelling. Yet, as Roudier has found, 'the distribution of a single ton of groceries to a number of small grocers in the Paris area costs more than their carriage by road in 20 tonne lots from Marseille to Paris'. This demonstrates the variability of costs with conditions and, consequently, the importance when costing, of considering each journey separately.

There is a variety of sources of information on operating costs. These include tables of operating costs published annually by Commercial Motor (CM), cost tables published quarterly by Motor Transport (MT), the Cost and Rates Service of the Freight Transport Association (FTA) and the operating costs published by the Road Haulage Association (RHA). All these tables are based on generalised costs for various types and weights of vehicle. The use of both imperial (tons) and metric (tonnes) weights in this paper reflects the current state of practice in the U.K. For the purposes of this paper there is no significant difference between a ton (1016 kg) and a tonne (1000 kg). Table 1 shows, as an example, costs of articulated vehicles of various weights taken from CM.

Table 1 shows the main components of operating costs and their relative magnitudes. It can be seen for instance that wages form a large proportion of standing costs per week and that fuel is the most costly component of running costs. These relative magnitudes are apparent in all the operating cost tables. However, each of the tables differs in the cost elements included.

TABLE 1 - OPERATING COSTS OF ARTICULATED VEHICLES OF DIFFERENT WEIGHTS

Carrying capacity	10 ton	14 ton	21 ton
Unladen weight	4 ton	5 ton	11 ton

Standing costs (pounds per week)

Licences	11.33	17.11	50.88
Wages	206.30	206.30	237.59
Rent and Rates	13.35	15.6	17.51
Insurance	23.32	32.60	61.85
Interest	41.64	49.20	79.87
TOTAL PER WEEK	295.96	320.82	456.54

Running costs (pence per mile)

Fuel	14.5	17.5	25
Lubricants	0.53	0.53	0.54
Tyres	5.96	5.36	6.25
Maintenance	11.8	14.66	23.68
Depreciation	8.52	10.06	14.55
TOTAL	41.47	48.11	70.02

Source: Commercial Motor Tables of operating costs 1982/83.

CM for instance is the only one to include interest as a separate item. This represents the interest payable on the money borrowed to purchase the vehicle, or alternatively if the vehicle was purchased from acquired capital, the interest that money could have accumulated if deposited in, say, a bank. CM also includes a rent and rates item as well as adding 20% to operating costs to cover overheads. MT includes an element called 'establishment costs' which is essentially the same as overheads and comprises telephone and mail (10%), administration staff (40%), rent and rated (15%), company cars (20%), light and heat (5%) and financial costs (10%). FTA and RHA have no items to cover rent and rates, but do include an 'overhead' figure. Depreciation, although included in all sets of tables, is included as a running cost in CM, but as a standing cost in the FTA, RHA and MT tables. In reality it will be a mixture of the two, for although a vehicle depreciates in value even if it is never used, it depreciates at a faster rate with increasing mileage. The same thing occurs with wages, which MT and CM class as a standing cost and FTA and RHA class on its own.

It is recognised that there are many problems associated with the use of operating cost tables (see for example Button and Pearman, 1981; Headdon, 1981 and Hicks, 1977). Rowley et al (1983) for instance, say about them, 'At best they represent averages subject to considerable variance'. It would be unwise for an operator to use such tables without considerable adaptation to suit his own requirements and conditions. The main problem is, as Rowley et al have said, their generality. Table 1 shows that a single cost figure is given for each component of costs for each vehicle weight category. Yet in Table 2 which is taken from the FTA Cost and Rates Service, and shows the operating costs of different makes of vehicle of the

same weight, it can be seen that the costs vary enormously between vehicle makes, although since the costs were taken from many operators the differences will, to some degree, reflect differences in operations and conditions.

TABLE 2 - VEHICLE OPERATING COSTS. DIFFERENCES BETWEEN COSTS FOR ARTICULATED VEHICLES OF SIMILAR WEIGHTS (30-32 TONNES)

	Example 1		Example 4		Example 9		Example 10		Average
Make of tractor	Volvo F7		Leyland Buffalo		Volvo Various		Erf B Series		
Total wage cost (£)	8019		10239		10411		19460		12034

Standing costs (pounds per annum)

	£	%	£	%	£	%	£	%	£
Licence	1820	33	1820	30	1820	27	1820	33	1820
Insurance	105	2	130	3	499	7	220	4	223
Depreciation	3578	65	4048	67	4526	66	3554	63	4025
Total S.C.	5503	100	5998	100	6845	100	5594	100	6068

Running costs (pence per mile)

	p	%	p	%	p	%	p	%	p
Fuel	13.8	44	18.8	48	17.0	62	17.2	33	17.5
Replacement tyre	8.28	27	2.43	6	2.68	10	3.4	7	3.73
Repairs	8.97	29	17.8	46	7.8	28	31.7	60	15.1
Total R.C.	31.0	100	39.0	100	27.5	100	52.2	100	36.3

Source: Abstracted from FTA Cost and Rates Service. Report number 48, March 1983. Table 5.

For example, in Table 2 total running cost per mile varies from 27.49p/mile for a Volvo (example 9) to 52.23p/mile for an Erf B series (example 10). This is nearly a 100% difference. Similarly, total cost per mile for vehicle plus driver ranges from 60.12p/mile, again for the Volvo (example 9) to 103.15p/mile for the Erf. This difference in costs for types of vehicle in the same weight category was recognised by one operator (interviewed by one of the authors), who was using a Volvo F10 because of its cost advantages despite having a franchise with another vehicle manufacturer. The variation in costs effectively means that if a haulier using an Erf were to use the average value rather than the specific value for the Erf, over 100 miles he would, according to the FTA figures, be undercosting by 744p, or, given an annual mileage of 44000 miles, he would undercost by £3300.

It is also interesting to note the differences between published cost tables. Table 3 shows the differences after making the tables as compatible as possible.

TABLE 3 - DIFFERENCE IN COSTS BETWEEN FTA, CM AND MT TABLES FOR A TYPICAL 32 TONNER

	FTA averages (excludes VAT)	CM (includes VAT)	MT (excludes VAT)	RHA
Standing costs (pounds per annum)				
Insurance	223	2774	1511	1503
Depreciation	4025	5712*	5467	4520
Wages	12034	10618	7253	6337
Interest	not included	3593	not included	not included
Rent and rates	" "	3594	" "	" "
Running cost per mile (p)				
Fuel	17.5	25	25	21.14
Maintenance	15.07	17.10	18.07	5.21
Tyres	3.73	6.25	6.98	5.04
Oil		.54	.41	+
Total annual cost (43700 miles)	32145	44890	36094	35354

*using 13.07p/mile for average mileage of 43700 miles

+included under 'fuel'

Source: MT Cost Tables, Autumn 1983, CM Tables of operating costs 1982/83, FTA Cost and Rates Service, March 1983, RHA Cost Tables 1983.

Table 3 shows that insurance costs per annum range from £220 in the FTA tables to £2774 in CM tables, with MT at £1511. Wages range from £7253 in MT to £12034 in FTA. Total annual cost ranges from £32145 in the FTA tables to £44890 in CM tables, a difference of nearly 40% (though they are not strictly comparable in percentage terms owing to the omission of the licence fee which was not comparable in the tables).

The differences result partly from the data on costs not being based on the same month. There is, for example, a 6 month difference between MT and CM table cost bases. It is, however, the overall magnitude of the differences which is important. Correcting for the time variations in fact magnifies the cost differences since the CM tables (in Table 3) are the most dated and, at the same time, show the highest costs.

The comparisons above assumed equivalent working conditions, although since the vehicle working conditions differ tremendously too, the possible variations in cost per mile for vehicles of similar weights become even greater. Thus, for example, operating costs per mile in urban areas or other congested areas will be very different from those in free flowing traffic areas. Roudier (1976) found that the average run in Paris was a mere 49km because of congestion. He concluded that concentration of traffic had a greater effect on costs per mile of operation than the size of the urban area. Similarly, Ogden (in Button and Pearman, 1981) found that traffic congestion could decrease goods vehicle productivity by 75% and increase their operating costs by 100%.

According to the formula used by the Department of Transport when evaluating trunk road proposals, operating costs decrease with increasing speed according to:

Cost = (A + B/V) + CV²

where V = speed in km per hour, and

A, B, C are parameters which vary with vehicle type.

For a goods vehicle A = 14.76, B = 82.2, C = 0.000227 (1979 prices).

Using this formula, the effect of decreasing speed from 60km/h to 30km/h is to increase operating costs by 4%. However, if a vehicle travels more slowly, then the time costs will also increase. Total resource costs used must therefore also include a time variable. The Department of Transport recommends that time enters the equation in the following way

Cose = (A + (B + D)/V) + CV²

where D = value of vehicle time in pence/hr.

It would only be by luck that the combination of variable and constant values used would give the same cost as that obtained from the use of generalised tables.

The RHA deal with this problem to a certain extent by publishing regional tables of operating costs. However, it is not only the traffic conditions which ensure that operating costs vary greatly between operators. Among haulage companies themselves there are substantial differences in practices. Hauliers have differing attitudes to maintenance. Maintenance costs also differ according to whether the work is done within the firm or outside it. Depreciation varies according to the capital cost of the vehicle, the method used (i.e. straightline, reduced balance or some other method), and also according to the second hand value the haulier believes the lorry will achieve at the end of its life. The life of the vehicle depends on the use made of it and the replacement policy of the firm. Many hauliers do not purchase vehicles outright but lease them or contract hire them and the acquisition method used affects costs considerably. Running costs as a whole will change with the treatment of the vehicles in question.

A further criticism of a different nature was advanced by an FTA accountant who said 'there are two elements of cost, viz. time and distance. Total cost is an always varying function of the two. Thus it is totally wrong to reduce total cost to a figure per mile, a mistake made by nearly all operators and by most published cost tables. There is only one period mileage at which the average per mile is correct; below that figure it will be too low and above it too high. Herein lies the problem of so many operators who still rely on this fictitious non-existent figure' (FTA, 1983). The solution to this problem may lie in charging a cost per mile based on running costs and a cost per hour based on standing costs. It is essentially this approach which was adopted by the Department of Transport in their calculation of trunk road benefits (above).

An equally serious problem arises through the assumption of a 100% capacity utilisation. Capacity utilisation will obviously change from day to day and from business to business. The payload factor for the average vehicle of GVW above 30 tonnes is only 0.73 (excluding empty running) (CSRGT, 1983), making the costs per tonne correspondingly higher. CM actually present cost figures for the situation where only 50% or 75% capacity utilisation is attained. However, the nature of their presentation makes their use difficult. Table 4 is abstracted from the CM tables and shows the operating costs per ton of an articulated vehicle with 21 ton capacity and 32 tons GVW.

TABLE 4 - OPERATING COST PER TON OF A 32 TON GVW ARTICULATED VEHICLE WITH DIFFERENT UTILISATION FACTORS

Miles per week	Journeys per day	Utilisation (%)	Cost (£)
1000	1	50	22.03
1000	1	75	14.69
1000	2	50	11.02
1000	2	75	7.34
1000	3	50	7.34
1000	3	75	4.90
1000	4	50	5.51
1000	4	75	3.67
1000	5	50	4.41
1000	5	75	2.94

Source: CM Tables of operating costs 1983/84. Table 6, p. 33.

Having decided upon his mileage per week, the haulier must decide how many journeys per day he has made. Assuming he works a five day week, has travelled 1000 miles, and made on average 2 trips per day, in order to use the tables, he must further assume each trip was of the same length - in this case 100 miles. Cost per ton for 50% utilisation is calculated by taking the total operating cost per mile of a fully laden vehicle, for 1000 miles, and dividing it by the actual payload carried, i.e. 10.5 tons - which gives 11.02p per ton and then multiplying this by miles per trip (i.e. 100), to give £11.02 per ton.

Apart from the simplifications concerning equal journey lengths, there is an apparent error in calculating cost per ton of payload using this method. It assumes effectively that operating costs for a vehicle with GVW of 32 tons is the same as that of a gross vehicle weight of 21.5 tons (i.e. unladen weight plus actual payload at 50% capacity utilisation). This is clearly not the case. Because the running costs of a half laden vehicle would be less than those of a fully laden vehicle, it is surely incorrect to find cost per ton of weight carried by dividing the total operating cost of a fully laden vehicle by the actual payload. This same error is made by Sharp (1973), who states, in explaining the difference made to costs by differences in capacity utilisation that if Cs and Cl are the operating costs per vehicle mile of small and larger vehicles and Us and Ul are their respective carrying capacities, then the difference in costs per capacity ton mile is given by

(Cs/Us) - (Cl/Ul)

If the load factor expressed as a proportion of capacity is k, then the difference in costs per ton mile (assuming equal mileage for larger and smaller vehicles), R is given by

R = (Cs/kUs) - (Cl/kUL)

However, if k<1, then there will be effects on Cs and Cl which are not accounted for by this equation.

2.2 The use made of published cost tables

These very aggregate tables appear to be of little practical use to the
haulier without a great deal of adaptation. In fact, it is questionable
whether they serve any useful purpose other than demonstrating trends in
costs. It would be helpful to know how many firms use the tables, the
extent to which they are adapted and the use to which they are put. The
Price Commission Study of 1977 gives some indication of the extent of their
use in the setting of charges by professional operators (This, of course,
excludes the large number of own account operators who would be expected
to use the FTA tables, if any).

TABLE 5 - PROFESSIONAL HAULIERS - USE OF SOURCES OF INFORMATION IN SETTING CHARGES

	Percentage of Respondents making stated degree of use			
Source	Frequently	Occasionally	Hardley Ever	Never
RHA	28.3	31.1	12.6	28
FTA	4.4	S.9	5	81.7
CM	27.7	33.7	13.9	24.7

Source: Price Commission 1977, page 42.

Although this source is a little dated, it can be seen that a significant
proportion of professional hauliers, i.e. hire and reward operators, use
cost tables in setting charges. However, Table 5 tells us nothing about
how many changes are made to the tables by operators, or the extent of
hauliers' reliance upon them.

The use of published tables is not confined to hauliers. Because of the
lack of credible or comprehensive alternatives, they are used by academics
and governments alike. Cooper (1982) used the tables to consider the
economic viability of using demountables in distribution. Patterson and
May (1982) used MT tables to calculate the impact on costs of having heavy
lorry bans in London. Corcoran et al (1980) used elements of the CM
tables in their report on the evaluation of heavier lorries, which was
used as a basis for the Armitage Report (1980). The Wood Inquiry (1983)
into the effects of bans on heavy lorries in London used MT tables to
enumerate the costs. Finally, Starkie (1984) used CM tables to demonstrate
the costs of road freight transport. In fact, practically all research
in this field which includes enumeration of vehicle operating costs,
used information obtained from the published cost tables. That the tables
are so widely used is rather worrying since conclusions reached by these
bodies can have far reaching effects. Yet, as shown above, conclusions
are likely to differ according to the tables used. Where the conclusions
reached are based on calculations which are very sensitive to marginal
changes the problem becomes worse.

2.3 Example of the use of published cost tables

As an example of the ambiguities resulting from the use of published tables of operating costs, consider the debate over the introduction of the heavier vehicle. One of the major factors influencing the final decision to introduce heavier 38t goods vehicles in the UK in May 1983, was the projected savings in operating costs resulting from the purported economies of scale in the use of heavier lorries. The argument was that although the operating costs of heavier lorries increase with increasing GVW, payload capacity increases at a faster rate resulting in lower costs per tonne of goods carried, assuming a fully laden vehicle. It was reckoned by Armitage (1980) that savings of £120m - £135m p.a. would be gained through the change in the weight limits of lorries.

Using the published tables of operating costs, however, the relative financial advantages of operating the 38 tonne vehicle as opposed to 32.5 tonne vehicles are seen to differ quite substantially between tables. Table 6 demonstrates this.

TABLE 6 - VARIATIONS IN ESTIMATIONS OF THE RELATIVE COST ADVANTAGE OF 38 TONNE ARTICULATED VEHICLES OVER 32.5 TONNE ARTICULATED VEHICLES

	CM	MT	FTA average
Cost per mile (1500 miles)			
32.5* tonne artic	91.7p	83.5p	67.1p
38* tonne artic	115.1p	92.1p	74.1p
Cost per tonne/mile (1500 miles)			
32.5 tonne artic	4.2p	3.8p	3.1p
38 tonne artic	4.6p	3.7p	3.0p
Percentage difference	+ 10%	- 2.6%	-3.2%
Cost of transporting 1000 tonnes of goods 300 miles in			
32.5 tonne artic	£13009.3	£11918.3	£9034.8
38 tonne artic	£13842	£11181	£8894
Difference	-£832.7	£737.3	£140.8

* 3 axled tractor with 2 axled trailer

Sources: Calculated from CM tables of operating costs 1983/84, MT operating cost tables Winter 1983, FTA cost projections 1983

Table 6 shows that although costs per mile are higher for the 38 tonne vehicle in all the tables, costs per tonne mile are lower in MT and FTA but higher in CM. CM predict a 10% increase in costs per tonne mile if a 38 tonner is used rather than a 32 tonner. The third part of Table 6 shows what this means in terms of an example taking into account vehicle indivisibilities. Thus, suppose a haulier needed to transport 1000 lorries of goods 300 miles. Suppose also that one lorry can travel 300 miles a day and work five days a week. Using a 32.5 tonne lorry with 22 tonne capacity, it would take 46 journeys, the haulier would travel 1500 miles a week for 9 weeks and 300 miles in the final week. The cost of this compares to what it would cost if he were to use a 38 tonne vehicle with 25 tonne capacity. In this case he would

travel 1500 miles a week for exactly eight weeks. Table 6 shows it would cost £832.7 more to use the 38 tonner based on CM figures, £737.3 less to use a 38 tonner based on MT figures and £140.8 less according to FTA figures. This is quite a substantial variation. On this basis, had the decision on whether to introduce the heavier lorry been based on CM, the outcome would not have been the same as if it had been based on MT or the FTA. The magnitude of the savings resulting from the 38 tonner would be completely different according to the tables used.

The result of the debate on the heavier vehicle and the projected magnitude of the savings was based on a report by the TRRL (Corcoran et al, 1980). The sources of their costs were quite varied and credit must be given to them for using independent sources for many of the cost elements. However, for rent and rates and insurance, the figures were based on CM tables of operating costs. The framework used was that of CM (this means the inclusion of interest as an element) and the method used for calculating overheads, i.e. adding a fixed percentage to costs previously identified, is the same as in CM. Whilst it is quite understandable that the TRRL should have used CM tables because of the lack of better alternatives, the fact remains that had figures from the other tables been used, the results obtained by the TRRL may have been quite different. For an average mileage of 36871 miles (as used by TRRL) standing costs account for approximately 45% of total annual operating costs and rent, rates, insurance and interest account for more than 30% of the standing costs in CM.

Ultimately, the decision whether or not to purchase 38 tonne vehicles as opposed to 32 tonners and therefore the overall use of 38 tonners, rests with the transport providers. It is their opinions on the relative financial advantages that matter and their methods and attitudes to costing that should be of concern to both the academic world and to government.

The few general studies in this area have in fact shown that hauliers' knowledge of costs is poor. The Price Commission (1977) found that 'among small operators, knowledge and grasp of costs was often found to be rudimentary, ranging down to almost totally subjective rule of thumb judgements derived from experience'. However, it appears that there is a difference between small operators and large operators for the Price Commission also found that 'it was the larger hauliers who took greater care to analyse their costs and to make sure they included all economic costs including capital costs'. This difference in practice between larger and smaller firms can also be seen from the finding that when setting prices, 76% of those operators with between 21 and 100 vehicles used mainly their own costs to set prices whereas only 58% of those with 2 to 5 vehicles did. 24% of the latter type of operators used competitors' charges to set their prices. Strangely perhaps, of those operators with 101+ vehicles, only 69% set their prices on their own costs. However this may be explained by the fact that there were few operators with 101+ vehicles in the sample, so the percentages may be misleading. The Price Commission, whilst delving further than most into the costing knowledge of operators, is now rather dated and contains very little detail. There is clearly a need, then, for an up-to-date thorough knowledge of the actual costing procedures used by transport providers.

3. EMPIRICAL STUDY OF FREIGHT COSTINGS

3.1 Size of firms in sample

The remainder of this paper seeks to show exactly what costs operators take into account, the reasons for doing so and the use made by them of published cost tables such as those described above. In order to obtain this information with a high degree of detail, in-depth interviews of all decision makers in the costing exercise were made. In this way the relevant decision makers were more easily identified and had the opportunity to acquaint themselves with the interviewer. This is especially important in the sensitive area of costing where hauliers were expected to be rather reluctant to divulge the required information. Visits to nine hire or reward and nine own account operators in south-west England were arranged, each lasting about two days. The size of the firms visited in terms of white collar employees in the transport division, number and types of vehicles and activities of the company together with the main products hauled are shown in Table 7.

Firms varied quite substantially in size, activities undertaken and products hauled, although four of the hire or reward companies hauled for the same quarry business. Without exception, each hire or reward company had verbal work contracts with at least one manufacturer which accounted for a very sizeable proportion of their total work (in one case, over 80%) and which were of long term duration.

Only two of the hire or reward firms were part of larger organisations, the remainder being predominantly family-run businesses. All were fairly well established firms, the newest had been operating for eighteen years and the oldest for 65 years. They all began purely as haulage companies and most later diversified vertically into other aspects of distribution or related work.

The own account companies were much larger in terms of total numbers employed and annual turnover, although in terms of transport operations their sizes were quite comparable with the hire or reward companies. All but two of the own account operators were national concerns with depots in at least one other location, and many of them were subsidiaries of larger organisations. The own account firms were spread over a wider geographical area than the hire or reward firms because of the limited number of own account companies in the far south-west using the heaviest categories of lorries.

3.2 Use and opinion of published cost tables by firms in this study

This paper began with a critique of published cost tables and the use made of them in academic and government circles where they are sometimes assumed to be an accurate representation of hauliers' costs and, therefore, a determinant of hauliers' decisions. Table 8 shows the extent to which transport providers used published cost tables and their opinions of them.

TABLE 7

SIZE OF FIRMS IN THE SAMPLE IN TERMS OF NUMBERS OF VEHICLES, ACTIVITIES OF FIRMS AND

NUMBERS OF WHITE COLLAR EMPLOYEES

FIRM	No. office staff in transport	Number and weights of vehicles	Activities of firms	Main product hauled
Hire or reward				
1	8	4 x 32t artics on general haulage 22 x 7.5t (distributor) 14 x 3.5t (contracted) 8 various	Haulage, distribution, rental, contract hire, storage, garage* and diesel sales	Beer, timber and steel products
2	5	7 x 32t artics 9 various	Haulage, storage, cement works, training scheme, derv sales	Televisions, cement
3	18	17 x 38t artics 9 x 32t artics + 36 others 23 x 32t artics (rentals)	Haulage, garage, derv sales, contract hire, forecourt	Quarry materials
4	2	4 x 32t artics 2 x 38t artics 2 others	Haulage	Fruit and vegetables, machinery
5	4	17 x 32t artics	Haulage, garage	Chimneys
6	3	5 x 32t artics 1 x 38t artics 1 x 36t artic 4 others	Haulage, garage	Steel, construction plant
7	4	15 x 38t artics 7 x 32t artics 12 others	Haulage, storage, distribution	Tinned food, dairy produce
8	7	7 x 38t artics 8 x 32t artics 8 x 30t rigids 10 various	Haulage, storage, distribution, derv sales	Coal, sand, toys
9	8	51 x 32t artics 3 x 38t artics 58 x 16t rigids	Haulage, distribution, garage	Milk, oil

*.Garage in this table means repairing other vehicles as well as their own.

TABLE 7 - continued

FIRM	No. of office staff in transport	Number and weights of vehicles	Activities of firms	Main product hauled
Own account				
10	4	22 x 38 tonne artics 5 x 32 tonne artics 2 x 16 tonne rigids 9 x 3.5 tonne rigids	Producer and distributor of alcoholic drinks	Alcoholic drinks
11	1	2 x 38 tonne artics 1 x 32 tonne artic 1 x 24 tonne rigid 4 x 16 tonne rigid	Catch fish, buy fish and distribute it	Fish
12	4	1 x 38 tonne artic 12 x 30 tonne rigids 1 x 30 tonne artic 4 x 28 tonne rigids 4 x 24 tonne rigids 3 concrete mixers + others	Quarriers, road construction and hirers of farm spreading equipment	Stone
13	4	12 x 30 tonne artics 17 x 10 tonne vehicles	Producers and distributors of alcoholic beverages. Garage.	Beer
14	4	19 x 32 tonne artics 5 x 24 tonne rigids + many delivery vans	Food manufacturers	Food
15	3	1 x 32 tonne artic 5 x 30 tonne rigids 5 x 24 tonne rigids 10 x 16 tonne rigid	Producers of animal foodstuffs	Animal foodstuffs
16	4	9 x 32 tonne drawbars	Manufacture hazardous chemicals for household/ business use	Chemicals
17	2	3 x 32 tonne artics 26 x 16 tonne rigids	Produce beer and distribute many types of alcohol	Beer
18	Approx. 14	4 x 38 tonne artics 42 x 32 tonne artics 56 x tippers (various weights)	Quarriers, engineering, garage, derv sales, bodybuilders, waste disposal	Quarry materials, machinery and coal

TABLE 8

EXTENT OF USE OF PUBLISHED COST TABLES BY TRANSPORT PROVIDERS IN THE SAMPLE

FIRM	Cost tables received	Used for costing/pricing (Y/N)	Use put to	Opinions of tables
Hire or reward				
1	CM, MT	N	Use them to compare with own rates out of interest	Not much use for costing or pricing. The published rates are always too high.
2	CM, MT	N	Likes to compare them with own costs. Shows them to customers to demonstrate how low own rates are.	Not much use for costing. Unreliable. Always too high.
3	MT, RHA	N	Occasionally uses them for comparisons and to justify own rates to clients.	Only has MT because they are free with the paper. Does not like CM because based too much on mileage.
4	RHA, MT	N (except uses RHA wage rates for drivers)	None except the occasional inquisitive comparison against own rates.	Both too general and do not fit own firm's circumstances. Overheads in tables too high. Costs based on different mileage than own vehicles and has no inclination to adopt them.
5	RHA, MT	N	Comparisons with own rates. Took own cost framework from RHA.	Used to rely on RHA for costings but realised that it was better to do their own because circumstances differ so much. Get RHA tables only because they are free now.
6	RHA, MT	N	Uses them to refer to occasionally. Used to use MT framework about 8 years ago before giving up costing. Uses them to justify rate increases.	Prefers RHA tables because they are regionally based and therefore should be more accurate. Both are too high.
7	RHA	N	Comparisons with own rates.	Believes RHA tables are dubious and CM and MT are hopeless.
8	RHA	Y	Rate setting for new one-off customers.	Uses them because it it easy to do so and because it sounds professional.
9	MT, CM	N	Comparison with own costs.	Very unrealistic.

TABLE 8 - continued

FIRM	Cost tables received	Used for costing/pricing (Y/N)	Use put to	Opinions of tables
Own account				
10	CM, MT	N	Transport manager does not even look at them, but distribution manager uses them for comparisons.	Believes they are inaccurate.
11	MT	N	Uses them to get an idea of market rates. Believes they are an accurate representation of other people's actual costs.	Thinks that some items are quite good but overall are no good for the particular geographical area.
12	MT, RHA, DSF	Y	Uses RHA and Devon Stone Federation for pricing transport element of total price.	Has no faith in CM and MT tables because everyone's costs vary. DSF and RHA tables used because it is agreed in the trade and it makes things easy. Believes DSF and RHA not very accurate.
13	MT, FTA	N	Used as comparison with own rates and to get idea of "commercial rates".	Believes they are made for a different kind of operation than theirs.
14	CM, MT, FTA	N	Used to compare with own rates and to get an idea of market rates. Hires H/R transport occasionally and believes can give an idea of the hire or reward rates. Personnel dept. uses them to keep transport manager on his feet.	No specific opinion expressed.
15	FTA, CM, MT UKASTA	N	Send their costs to UKASTA who analyse them in their framework and also send a copy of other members in the group's costs in the same framework. Also distribution manager at head office enters own costs into FTA computer and gets breakdown in their format too. At depot visited the transport manager compares depot costs with other depots but not very often.	Believes UKASTA and FTA tables are better than MT and CM as they are more suited to their own operation. Head Office thinks the comparisons are worth-while and the tables are useful.
16	MT, CM	N	Used them to justify transport costs to managers higher in the hierarchy. Used as comparison.	Believes they are useless. Get them out of curiosity.

TABLE 8 - continued

FIRM	Cost tables received	Used for costing/pricing (Y/N)	Use put to	Opinions of tables
Own account				
17	None	-		Has little use for them. Not interested in other peoples' costs.
18	MT, CM, FTA, RHA, DSF	N	Used as comparisons with own costs. Like to have them to refer to even though they have little faith in them.	Does not like them because do not know what they are based on. Also they are at times difficult to interpret. However, since they are published and are on a subject of direct relevance to them, they should be looked at.

DSF   =   Devon Stone Federation

UKASTA   =   UK Agricultural Supply Trade Association

Published cost tables were used by only one of the hire or reward
operators and by one of the own account operators for the purpose of
costing or rate setting. The exceptional hire or reward operator used
them only to quote to a new one-off client when he thought it ill-advised
to spend time working out a price based on their own costs. The own
account exception used them mainly because it had been agreed within the
industry to do so. The tables were not rated very highly by the operators
who appeared more inquisitive of their content than convinced of their
usefulness. A majority of the transport providers received MT tables
because they came free with the Journal which was subscribed to for its
wider coverage of transport issues and not merely for the cost tables.
RHA tables were received by many of the hire or reward operators because
these tables are sent free to members requesting them. It is interesting
to note that CM tables which have to be ordered and paid for separately
from the magazine (price £3.50) were only obtained in eight of the cases.
More own account operators than hire or reward hauliers subscribed to CM.

Most of the hauliers were intrigued by some of the rates contained in the
tables and all said that their own rates were lower than those of the
tables.. The most useful aspect of the tables seemed to be that hauliers
could show them to their customers to justify their own rates when
customers complained of rates being too high, or own account operators
could show them to those in higher management to justify the transport
department's expenditure. Similarly, hire or reward operators could justify
rate increases to customers. For most of the hauliers however, the tables
were used solely as a comparison with their own costs. Many operators
obtained the tables because they showed a keen interest in transport and
liked to read anything available on the subject. The prevailing attitude
seemed to be however that if their own costs were higher than those of the
tables, then their costs should be recalculated to check for mistakes.

Some of the own account operators used the tables to gauge the market for
outside haulage rates despite their belief that the tables were an
inaccurate representation of the costs in their own particular industry.
They thought that although the tables were unsuitable for their particular
type of operation, they were probably more suited to other hauliers'
operations and that other operators, therefore, would use them. Similarly
most firms also appeared to believe that they were doing well in keeping
their costs below those of the tables, thinking that the tables represented
other operators' true costs. The hire or reward operators said that the
only people likely to be able to obtain the rates suggested in the tables
would be. the own account operators when charging other departments in the
same firm. Thus most operators believed that other operators used the
tables. In fact, if the sample is indicative of national usage, only a
few operators actually did so.

3.3 Use of a cost framework

Published cost tables, then, do not figure highly in the costing exercise
of most of the sample. In practice, transport providers have quite a
variety of methods of costing, ranging from the nearly non-existent to the
quite elaborate. There seems little doubt that the first step in a thorough
costing system is a framework within which to work, usually comprising
standing and running costs. Without such a framework, vehicle costing is
practically impossible and it can be assumed that if no such framework
exists, no formal costing is done; of the total sample of eighteen, thirteen
firms used a costing framework. Table 9 shows the reasons given by the
five firms not using a framework.

TABLE 9

REASONS FOR NOT USING A COSTING FRAMEWORK BY HAULIERS IN SAMPLE

FIRM	Reason for non-use
Hire or reward	
4	Costing pointless because cannot get rates that the costs imply. Experience more useful than costs. Fleet small enough to keep close watch on anyway. Dislike of paperwork. Main customers dictate rates, therefore little use in knowing costs.
6	Costing pointless and time consuming. Rates depend on what market will bear and there is no other reason for doing costs. Difficult to cost spares because as the stock gets older there is no way of costing it accurately.
3	Insufficient time or staff to do costings although recognise the advantages of doing that. Will start in the near future.
Own account	
11	Fleet small enough to keep an eye on. Have enough administration to do without additional work generated by costings. Would not know what to do with them even if they were done. Transport is a service to the product and so costings are pointless.
12	Transport is a service to the product so costings are not necessary. Also there is insufficient time. Cannot see any advantage in costing because the company as a whole is profitable.

The main reason offered by the hire or reward firms for the absence of a
cost framework was that costing was pointless and time consuming because
the rates that the costs implied could not be attained. The market was
such that customers could dictate the rates they desired. They seemed to
be resigned to the belief that their power in the market place was minimal
and that unless the economic climate improved, they would always be
dominated by the manufacturers. Additionally, the costing activity was
disliked by some hauliers who had entered the business because they enjoyed
the practical nature of the business. Such operators did not appear to like
administration.

Most of the firms who did no costing were relatively small compared with the
other firms visited. This could be for one of three reasons. The first
is that small firms are less professional in their behaviour or less
ambitious in their outlook and therefore do no costings: the second is
that small firms are small as a result of doing no costings and not keeping
a tight enough rein on the financial side of the company; and the third is
that the result is a coincidence due to the small size of the sample.
Hypotheses number one or three seemed most appropriate within the sample
observed. The management of smaller firms seemed content that their firms
were small. There were no ambitions to expand because it was believed that
the bigger the firm the more unmanageable it became and the less personal
the contact between the owner/manager and both clients and staff. They
wanted to keep the firm small and intimate and to offer a personal service
to the customer. The only own account firms not to do costing were also
the only privately owned firms. In this case the total number employed
in the company was a better indication of the size than the number of lorries.

4. APPROACHES TO COSTING IN THE EMPIRICAL STUDY

4.1 Composition of cost frameworks

Thirteen of the eighteen firms visited used a formal costing framework.
However, the composition of the framework and the detail of the costing
varied considerably between firms. The complexity of the costing methods
used is shown in Figure 1 which has four parts:

Figure 1.1 The composition of the cost framework used

Figure 1.2 The variation in methods of treating just one of the
            elements in 1.1 - depreciation

Figure 1.3 The amount of detail in the costing method as shown
            by the unit of costing

Figure 1.4 Allocation of fixed costs amongst vehicles for costing
            purposes.

It can be seen from Figure 1.1 that there are both variations and
similarities in the composition of hauliers' costing frameworks. All
included basic cost elements such as wages, maintenance, fuel and tyres.
Only two firms, however, put much emphasis on accounting for inflation
when costing and only one included a substantial figure for bank charges
(interest).

FIRM/ ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		Hire	or	reward									Own	account				
Licenses	•✓	•✓	•✓		•✓		•✓		•✓	•			•		•	•		•
Vehicle hire	•✓	•✓												•	•	•		
Insurance	•✓	•✓	•✓		•✓		✓		•✓	•			•	•	•	•		•
Depreciation	(1)✓	(1)✓	•✓		•✓		•✓		•✓				•		•			•
Garage wages	•✓		•✓		•✓		•✓		•✓				•		•		•	•
Drivers' wages	•✓	•✓	•✓		•✓		•✓		•✓	•			•	•	•	•	•	•
Overheads (non specific)	•✓	•✓	•✓		•✓		•✓		•✓							•		•
Interest							•✓											
Equipment			•✓				•✓						•					
Inflation			•✓															•
Training levy			✓															
National Insurance			✓						✓									
Administration	✓	•✓								•						•		
Fuel	•✓	•✓	•✓		•✓		•✓		•✓	•			•	•	•	•	•	•
Oil	•✓	•✓	•✓		•✓		•✓		•✓					(2)	•			•
Tyres	•✓	•✓	•✓		•✓		•✓		•✓	•			•	(2)	•	•	•	•
Maintenance	•✓	•✓	•✓		•✓		•✓		•✓	•✓			•	(2)	•	•	•	•
Accidents	✓								•				•		•	•		

*Internal costs   ✓Costs taken into account when charging customers
(1) If vehicles are hired there will be no depreciation charge. Firms 1 and 2 had a mixture of owned and hired vehicles.
(2) Oil, types and maintenance are included in vehicle hire for firm 14.

FIGURE 1.2   DEPRECIATION METHOD USED

FIRM/ METHOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		Hire	or	reward									Own	account				
Tractors over 7 yrs	•✓	•✓	•✓		•✓		•✓											8 yrs
Tractors over 5 yrs								✓	•✓	✓			•✓				•✓	
Trailers over 5 yrs									✓				•✓					
Trailers over 7 yrs	•✓	•✓	•✓				•✓											
Trailers over 10 yrs									•									
Rigids over 8 years							•✓		•								•✓	•
Straight line basis	•✓	•✓	•✓				•	✓	•	✓					5 yrs		•✓	•
Reduced balance method					•✓		✓		✓				•✓					
Current cost basis		•✓					•										•	
Historic cost basis	•✓				•✓		•		•✓	•			•✓		✓			•
Residual value 12½%							•✓	✓										
Residual value otherwise					•												•	
No residual value	•✓						•✓	•		✓			•✓					•
Unknown				•		•					•	•						
Vehicles hired														•		•		

**Method used by transport managers   ✓Method used by accountant

FIGURE 1.3   UNIT OF COSTING

FIRM/ METHOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		Hire or reward											Own account					
Total costs of function yearly	•	•	•		•		•		•	•			•	•	•	•	•	•
Running costs of vehicles per period	•	•	•		•		•		•	•			•	•	•	•	•	•
Running costs of vehicles monthly	•	•	•		•		•		•	•					•		•	•
Hire costs of vehicles monthly														•				
Standing costs of vehicles monthly	•	•	•		•		•		•	(1)								•
Per weight category of veh. monthly									•									•
Per weight category of veh. weekly																		•
Per type of vehicle monthly		•																•
Per type of vehicle weekly																		•
Per vehicle monthly			•		•		•		•	•					•			•
Per vehicle weekly							•		•						•			•

(1) Standing cost per weight category of vehicle monthly.

FIGURE 1.4   ALLOCATION OF FIXED COSTS

FIRM/ METHOD	1	2	3(*)	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		Hire or reward											Own account					
Equally between vehicles	•				•													
Per vehicle according to weight							•											
Per vehicle according to days used							•											
Per vehicle on mileage basis																		
Fixed usage equally btwn vehicles			•															
Per indiv. veh. on actual figures		•																•
Per category of veh. on actual figures			•				•		•	•								

(*) Firm 3 allocated insurance costs between vehicles in the same ratio as the V.E.D. ratio between vehicles.

Figure 1.1 also demonstrates that in general, the hire or reward cost frameworks were more comprehensive than those used by own account firms, although there were exceptions. The own account firms calculated very basic costs but in only one of the firms was there any attempt to allow for inflation (other than in the depreciation element), interest, or other more detailed costs. In several cases the framework consisted only of running costs and even then the cost of oil was rarely included. In fact, on the own account side, the use of an explicit framework was rare. Obvious running costs were calculated in an ad hoc manner but they were often not collated into a framework to show the total running costs of each vehicle. The firm using a comprehensive framework was the exception rather than the rule.

In Figure 1.1 the non specific overheads item comprises different elements in different firms. Some, for instance, count equipment separately from overheads whilst others combine them. Similarly, for wages, some firms include national insurance and training levy together in the wages element and some treat them individually. In general the more cost conscious firms split the 'overhead' costs up into the most elements, calculating each item separately, so that the only item included in the general overhead figure was likely to be for office administration.

Figure 1.1 also shows that in a few hire or reward firms the items included in costs depended on whether the costs were for internal analysis or for use in charging customers. There was a tendency when charging customers to calculate costs more carefully; having more items in the framework meant that rates could be more sensitive to customer variables such as length of contract, type of work to be done or general credit rating of the customer. Often, once a rate was set based on costs it would not be changed for a very long time, so it was important to set the rate at the correct level from the outset.

4.2 Example of treatment of one element of costs: depreciation

Figure 1.1 does not fully illustrate the extent of the variations in cost frameworks between firms. Many items in the framework are treated differently in different firms. Depreciation is an obvious example of this, as is shown in Figure 1.2. The appendix to this paper briefly describes the different methods of depreciation. The method used depends partly on the vehicle replacement policy, ranging from the firm which runs a vehicle until it is fit for nothing and has no resale value to the firm which runs a vehicle for a shorter period and resells it whilst it is still in a relatively good condition. The policy adopted will partly depend on the type of vehicles used and the work they do. Rigid vehicles especially tippers, are often used on much harder work, in and out of quarries for instance, making short but difficult journeys. They will have a lower resale value in relation to purchase price than, say, an articulated tractor unit used on regular long distance runs. The replacement policy also depends on the image a particular firm wants to present. Some firms will sell their vehicles every three years to present a good image, others will think image irrelevant. Maintenance costs are also an important determinant of the length of the replacement cycle as are technical developments and, consequently, obsolescence. The decision on whether to use historic or current costs for depreciation must also be taken. Theoretically the cumulative depreciation of a vehicle should not just cover the price of that particular vehicle, but the price of a similar replacement vehicle. If historic costs have been used in times of moderately high inflation the shortfall in funds put by to purchase a new vehicle could be quite sizeable.

Although most firms in the hire or reward sample depreciated vehicles over a seven year period, this was not true of all firms. A couple of firms in the hire or reward sector used a five year period for tractors. The own account sector tended to use a five year period, probably because they have a higher annual mileage than the hire or reward vehicles. They often operated a double shift system, trunking at night and delivering locally during the day. Some firms used the straightline method of depreciation whilst others used the reduced balance method; some assumed no residual value for the vehicle, whilst others reduced the initial capital expenditure item to allow for it. Furthermore, some of the firms used historic costs for depreciation, while others used current costs to try to allow for inflation. Some firms had no idea what period or method was used.

Figure 1.2 also shows that in some firms different methods were used according to whether the costing was being done by the firm's accountant or the transport manager. The latter tended to use the straightline method because it was easier to use. In several cases there seemed to be a mistrust of the methods used by the accountant and it was for this reason also that separate methods were used. Many of the transport managers did not really seem to understand the concept of depreciation and went purely by what the accountant told them.

4.3 Units of costing

Figure 1.1 shows the elements taken into account but not the thoroughness with which they are calculated. Figure 1.3 therefore shows the variety of detail in the approaches to costing adopted by the firms in the sample. It can be seen that some firms calculated per vehicle costs, i.e. the costs of each vehicle for each period were calculated using actual figures collected internally. Some, however, only calculated costs for each category of vehicle, e.g. tippers, crane lorries, 16 tonners; some did very general costs for the fleet as a whole and some only recorded total running costs for the fleet. Again, it can be seen that there is a difference between the hire or reward firms and the own account firms. The own account firms appear to calculate their costs in much less detail with few of them calculating per vehicle running costs and only one of them calculated per vehicle fixed or standing costs. The size of the own account firms did not appear to influence their approach to costing but on the hire or reward side, it was the larger firms who went into the most detail in their costing, calculating costs for each vehicle separately.

4.4 Allocation of fixed costs

Allocation of fixed costs between vehicles also varied as shown in Figure 1.4. Firm 5 allocated them equally between vehicles because all the vehicles were of the same type. Other methods used included allocating costs according to the number of days worked by each vehicle and according to the weight of the vehicle. This was done because hauliers believed that the fixed costs borne by a vehicle should bear some relation to the usage made of the vehicle. Some firms claimed to know all the elements of fixed costs for each individual vehicle and so calculated fixed costs for each vehicle separately. Only one of the own account firms is included in this figure as none of the others allocated fixed costs among the various vehicles.

5. REASONS FOR COSTING

Figure 1 shows that the approach to costing varies among firms. The difference in amount of detail of the costing system may, to some extent, be due to the variations in reasons for carrying out costings in the first place. It may be expected for instance, that a haulier who is intent on attaining maximum possible efficiency from his fleet will want to monitor all costs very closely and very frequently. If costing is more a management exercise with no particular objective, however, the approach may be expected to be less thorough.

Table 10 shows that hauliers do costings for various reasons ranging from the monitoring of performance to aiding the setting of rates. The former was the most common reason given for costing, yet taking Table 10 and Figure 1 together, different companies have different ways of monitoring performance. Some thought it necessary to do per vehicle costings while others were content to know per category of vehicle costs. It is interesting to note that firm 2 which was striving hard to monitor costs because of previous financial problems, only felt it necessary to do per category of vehicle costs. Other firms, however, thought it necessary to do per vehicle costs as part of the daily routine to aid efficiency. Some of the hire or reward firms used costings to support haulage rate increases so that if clients questioned the rate increases the firm could at least justify them (sometimes using them along with published tables of operating costs). It also helped to give the impression of a well run and efficient business. This, they felt, was necessary because of the stereotyped image hauliers have of being badly run 'cowboy' outfits. The own account operators' main reason for costing was to monitor the overall performance of their department as well as that of individual vehicles in some cases. Without knowing total transport costs, it is very difficult to budget for the following year. In keeping with company policy most transport managers viewed the transport primarily as a service to the production side of the business. Providing a service was the most important aspect of the job, often almost irrespective of the cost. Many felt therefore that keeping per vehicle costs was a waste of time. Even among companies with detailed costings only one company thought they were a real advantage. Often costings existed because higher management had insisted on them. In such cases little use was made of them. Costings were, however, sometimes used for management control; knowledge of the costs of all the depots in the group was an incentive for the transport manager to keep his costs lower than others in the group. In only two cases was transport regarded as a profit centre. This, to a certain extent, indicates the lack of financial accountability in the transport department of many of the businesses. This is not to say, however, that transport managers were not forward-looking in their attitude to the transport system. Often much work went into improving it, but on a more practical, problem orientated level than on the basis of continuous monitoring of costs.

6. THE USE OF COSTS IN RATE SETTING

Few of the hauliers used the costings for rate setting in a sophisticated way. The main contribution of costs to rates was to set a minimum rate below which hauliers were loathe to work. This was usually a very approximate figure used to cover any vehicle over, say, 24 tonnes gross vehicle weight. However, even this was flexible; most hauliers interviewed were prepared to accept less and even to incur a loss on some journeys for valued customers. Indeed, rate setting was viewed by some as a totally independent activity from costing. In several cases observed, the

TABLE 10

REASONS FOR COSTING

FIRM	Reasons for costing and opinions of costing system
Hire or reward	
1	There are different attitudes to costing in different parts of the company. Head office demands that costings are done although the particular branch visited does not use the information available except to keep an eye on the overall costs of the operation. The depot manager thought that the information obtained was too detailed. He would prefer to make the depot as a whole profitable rather than each division within the depot. Costing each division made internal competition too stiff and employees worked towards profitability of the division at the expense of depot profitability and efficiency.
2	This company was previously in very bad financial trouble and had reduced their fleet tremendously as a result. They therefore felt it necessary to scrutinise costs to ensure that the same thing did not re-occur. They continuously conduct experiments to find the most efficient way to operate and are especially concerned with keeping costs constant and fore-castable. They appeared to be quite pleased with the costing system.
3	The managers do costings to know exactly how well the company is doing. They felt this was necessary with such a large firm, for otherwise there was no way of monitoring performance. Much thought goes into making the system work and keeping good records. The manager believed it worked well.
5	This firm did costings to aid rate setting. The manager felt it necessary to know the running costs of his fleet to give him an idea of his minimum rate. He felt it was easier to ask for rate increases if he could show he knew what his costs were. He also liked to know how the firm was doing.
7	Costings were done to monitor performance. As the manager was not very technically minded he liked to make up for the inadequacies in this area by being extra careful on the costing side. Costs were not used for setting rates much to the rater's dismay. The manager believed the costing system to be simple but effective.
9	Costings were done to monitor performance. It is all carried out on computer; the system is very flexible and the managers are very pleased with it.

TABLE 10 - continued

FIRM	Reasons for costing and opinions of costing systems

Own account

10 — Running costs calculated as a monitoring exercise to ensure that vehicles performing exceptionally well/poorly would become apparent. They were kept also so that could be used in the course of planning. The transport manager was not keen on costing, he believes the practical problems and the wide variation of circumstances in transport meant that costing was of less use to him than a good communication line between the drivers and himself. Transport was a service to production side and it was this service that was of paramount importance irrespective of its cost. Transport not a profit centre although the garage is.

13 — Costing done for monitoring purposes principally, but also for planning and analysis purposes. Costing not regarded as that important and only per period costings are done. Running costs are seen as the most important element of costs because they are most controllable; standing costs are of little interest to the management and only a total standing cost for the entire fleet is obtained by the management. Transport is not a profit centre.

14 — Costing is really only done thoroughly on the leasing element of costs. This is because leasing is done on a mileage basis and accounts for such a high proportion of total transport costs. (The lease includes maintenance, tyres and oil). Costs are done for monitoring purposes. Transport manager believes the costing system is adequate. He does not do per vehicle fuel figures because the lorries are refrigerated and it is difficult to tell whether the fuel is being used by the fridge or by the vehicle. Again, transport is regarded primarily as a service, so costs are not seen as being of paramount importance. Transport not a profit centre.

15 — Again, costs are done to monitor the performance of the vehicles. Running costs seen as the only controllable items and therefore the items of direct interest. Interdepot cost comparisons were valued as being of some importance in the company to try to give managers an incentive to reduce costs, as were the intercompany comparisons. The transport manager at the depot however was not too enthusiastic about costings because he believed there were always reasons why there were anomalies and inaccuracies. Transport is cost centre.

16 — Only the very general monthly costs are done because transport is viewed as a service to production and is required at any expense. The transport manager believed it would be practically impossible to do detailed costings because so many unusual factors were involved in the operation, i.e. no regular trips were made. The monthly costs were kept so that actual cost figures could be compared against budgeted costs. Not cost centre.

17 — Costs done to monitor vehicle performance. Not really interested in fixed costs because these were uncontrollable. Transport manager was not interested in per vehicle costs specifically, more in distribution costs as a whole. He liked to compare distribution costs per ton with those of other depots to see how the depot was faring. Not cost centre.

18 — Costs were monitored very strictly as a control mechanism. Without such costings they could easily get out of hand, it being such a large organisation. Both detailed and succinct costings were done so that no matter what purpose costings were desired, they would be available in the required format. It was felt that this was necessary if all strata of management were going to use them to their full advantage.

individual doing the costing was not the one setting the rates and in one particular case, the coster was frustrated that much of the effort put into collating accurate costs was being wasted because the rate setter ignored them and could not be persuaded of their potential in rate setting. Even in cases where the coster also set the rates it was usually only for the major customers. There was little correspondence between rates and costs for smaller customers and backloads, and rate setting was done by someone other than the coster.

Fifteen of the eighteen companies had business computers on which vehicle costings could easily have been calculated, yet only three of the firms used the computer for this purpose. Some other firms calculated per vehicle fuel, oil and maintenance costs on the computer. In general the computers were used for administrative and clerical work such as payroll and invoicing. The own account operators made more use of them than the hire or reward operators but their potential was greatly underutilised in both sectors.

7. CONCLUSIONS

The results of the study show that there is a great deal of difference in operators' approaches to costing. One of the most obvious conclusions is that the published tables of operating costs so often used by governments and academics, have little credibility with transport operators. They are rarely used for the purpose of costing or pricing, except, it seems, on the odd occasion when there is not the time to calculate a cost based on internal costs, or when a trade association stipulates it as a condition of membership (i.e. it is jointly agreed that all members should base their rates on a certain set of tables of operating costs). All but one of the firms in the sample had access to at least one set of cost tables. MT was the most popular set, although the included tables were never stated as being the main reason for the purchase of the journal which was to keep up with the technical developments in the transport industry. CM cost tables were not very popular with the hire or reward sector, but were more popular with the own account sector.

It is necessary for the efficient running of a business to know the costs of operating. The more detailed the costing and the more frequently it is done, the more accurately costs can be controlled. If costs are only kept in total, there is no method of determining what in particular has caused, say, a sudden rise in costs. By the time an investigation has taken place much money could have needlessly been wasted. Similarly, if only quarterly costs are recorded an unanticipated rise in costs during the period could occur which would take two months to discover and trace to its source. An efficient costing system should act as an early warning device against possible danger areas. When rates are based on costs it is even more vital to have such a device in operation, otherwise large losses could result from rates being out of line with costs. The haulier might argue that because he is in close contact with his drivers and mechanics, they will warn him when something is wrong. This is, however, leaving things to chance. They may only warn him when things get excessively out of line and forget about the 'little' things that can amount to a great deal in total. Additionally, if the control system works by word of mouth alone there will be no history of past events.

In general, the results show that the hire or reward operators had more detailed costing frameworks than the own account operators, although three of the nine hire or reward operators did no costings compared to two of the own account operators. The reason for the more detailed recording of costs on the hire or reward side may partly be explained in terms of the differences in risk faced; hire or reward firms face a much greater risk if costs get out of line whereas own account firms can usually turn to other departments in the firm for cross subsidisation if necessary. A hire or reward firm often has no such option and could easily face bankruptcy.

There are other possible reasons why the own account operators in the sample calculated costs less comprehensively than the hire or reward operators. Many of the hire or reward operators in the sample were owned by the transport manager, unlike the own account firms which, apart from two, were public limited companies. When the transport manager is also the owner, there may be more of an incentive to monitor and minimise costs than if there are no such links. The non-owning transport manager of course has an incentive to keep costs lower than those of other depots, or indeed, to keep costs below budget, in order to preserve his job. There is a difference between doing this and minimising costs. On the own account side however, the two owner-managers did no costings at all. Here transport was seen as almost a minor part of the business. The way to maintain profitability, it was believed, was to get the price of the final product right.

Another reason why own account operators were not always too concerned with costs could be that efficiency was not so much measured in terms of costs but by other measures such as vehicle utilisation. It was often believed that so long as the vehicle utilisation factor (measured by days on the road, tonnage carried or trips made) was high, then costs would be correspondingly low. Alternatively, success was measured by the number of complaints received regarding late delivery or non arrival of goods at their destination or availability of vehicles to dispatch the goods when necessary, i.e. a measure of service.

It was shown that all of the firms using a cost framework calculated basic costs such as fuel and maintenance, though attitudes to other costs were mixed. These basic costs are in fact the most important costs in terms of percentage of total expenditure accounted for by them, although quite large variations in costs could be caused by fluctuations in other costs.

The own account firms often said that they were minimising costs, yet because of their monitoring system, there really was no way of knowing this. Fixed costs often did not enter the cost equation at all on the own account side. It was felt that these were beyond their control and therefore were irrelevant. Yet some of the costs (e.g. the heating and equipment costs) were directly controllable by them.

Although a few of the firms in the sample had considered the costing exercise in some depth to find the system best suited to them, many of the methods used were fairly rudimentary and a proportion of the sample did no costings at all. Yet, most of the firms visited were very well established both in the hire or reward and the own account sectors. Inefficient costing methods, therefore, do not appear to have hindered success (although it may, of course, have reduced its scale). Traditionally hire or reward hauliers are viewed as existing in a very competitive market.

Such inefficiencies as are shown above therefore may seem unlikely.
The success of such firms seems to have depended to quite a large
degree on the carving of niches within which competition is reduced and
market power is enhanced. This is often achieved through a process of
specialisation. There are many types of vehicle in the market; tankers,
tippers, curtainsiders, crane lorries, lorries differentiated by size
and weight etc. The market is also separated by geographical location.
Thus, in any one geographical area there will be a limited number of
hauliers who can do a certain type of work and who, therefore, are in
direct competition. Thus, they have a degree of monopoly power and can
charge prices to cover easily their (estimated) costs. There will always
be a certain amount of competition from the 'one man bands' who are
perhaps more mobile, from firms in other areas who would take on the work
if the price were high enough, from nearby firms who could purchase
different vehicles of the desired specification if the price were right,
and from local firms who have similar vehicles which could be used if
the price were right. But so long as the price is kept at a reasonable
level, competition is perhaps quite restricted except at the margin of
each company's operations.

APPENDIX 2

ROUGH QUESTION GUIDE FOR INTERVIEWS.

A) General.

1. How many employees are there?
2. How many lorries?
3. What is the annual turnover?
4. What jobs do the employees do?
5. What size and type are the lorries?
6. What is the exact nature of the business?
7. Approximately how many loads are taken each week?
8. What is their average weight, volume?
9. What is the mix between contract hire and spot hire?

B) Approach to Costing and Rate setting.

1. Is a specific costing framework used?
2. What factors are taken into account and why?
3. What percentage does each factor account for?
4. Are wages and depreciation seen as a standing or a running cost?
5. How is depreciation calculated?
6. How is the residual value of the vehicles calculated?
7. What is the accounting life of the vehicles?
8. Is inflation taken into account?
9. How are overheads included? Of what do they comprise?
10. How is maintenance calculated? Is it done internally or externally?
11. What is attitude to maintenance?
12. How are standing costs allocated among vehicles?
13. Is interest included as a cost? If so, at what rate? If not why not?
14. Is fuel counted at discount or pump price?
15. Are lubricant costs calculated?
16. How is tyre scrub calculated?
17. What return on capital is a) achieved and b) desired?
18. What do they think of published tables of operating costs?
19. Do they ever use them? If so, what for?
20. Which tables are used?
21. How are rates calculated from costs?
22. How is capacity utilisation taken into account?
23. Is rate set per ton, per ton-mile, per mile?
24. How do rates vary between customers?
25. How have rates changed with the introduction of the 38 tonner?

METHODS OF DEPRECIATION

There are two principal methods of calculating depreciation; the straight-line method and the reduced balance method.

1. Straight-line method

This is the easiest method. Suppose the capital cost of a vehicle plus trailer is £50000. Suppose also that the vehicle is expected to last seven years and resell for 10% of its original value. Finally, suppose the tyres are worth £3000. The straight-line method involves reducing the capital cost of the vehicle by the residual value and the tyre cost and dividing the remainder by the life of the vehicle (in this sample 7 years)

So   £42000/7 = £6000

Each year depreciation on this vehicle will be £6000.

The main advantage of this method is its simplicity. The main disadvantages are that it takes no account of the fact that depreciation will be higher in the first few years than in the latter years or that maintenance is usually lower in the first few years and therefore to compensate, depreciation should be higher in these years. Additionally, it takes no account of inflation which means that the sum put by to purchase a new vehicle will be inadequate.

2. Reduced balance method

Assume the same capital cost and vehicle life as above. With this method the capital cost is reduced by a constant percentage each year. A residual value is chosen and then a discount rate, which reduces the original capital sum to the residual value over the chosen life, is calculated using the formula

$$S = C(1-R)^n$$

where S = Scrap or residual value
      C = Initial capital cost
      R = Discount rate
      n = Life of asset

Alternatively, an appropriate discount rate is chosen, say 30%, and this will be used to depreciate the vehicle. The sum left after the seventh year will then be written off.

e.g. suppose the interest rate is 30% and the sum to be depreciated is £40000 over 7 years:

```
                                   £                  £
Depreciation in the 1st year is  40000 x 30%  =  12000
                    2nd year is  28000 x 30%  =   8400
                    3rd year is  19600 x 30%  =   5880
                    4th year is  13420 x 30%  =   4116
                    5th year is   9604 x 30%  =   2881
                    6th year is   6723 x 30%  =   2017
                    7th year is   4706 x 30%  =   1412
                                                 _____
                                                £36706
                                                 _____
```

The remaining £3294 would be written off.

This method overcomes the first two disadvantages of the straight-line method, but still no allowance is made for inflation.

HIRE OR REWARD COSTING AND PRICING SIMULATION

INSTRUCTIONS

Please do the following costing and pricing simulation as realistically as possible. Do not attempt to answer the questions as you think I would like them to be answered, but assume that you were costing and pricing a real job.

The simulation involves answering a set of 12 questions based on an imaginary job opportunity. Each question changes one of the conditions of the original job opportunity and asks you to recalculate your answers taking into account this change. You may find that you give the same answer to more than one question; do not worry about this.

May I once again remind you that all information will be treated in the strictest confidence.

JOB OPPORTUNITY

It is Tuesday and your firm is in a relatively slack period. A new customer asks you to transport three loads of palleted tinned peas (retail value £500 per tonne) weighing 10 tonnes, 20 tonnes and 23 tonnes to Newcastle Upon Tyne for delivery on Friday. You know backloads will be available from Newcastle to your depot for which you will receive £250 per vehicle. (You may assume that the loads would fit into curtainsiders if desired).

QUESTION 1

a) How much would it cost you to transport each load to its destination assuming you could find no other goods to send with the 10 tonne load?

b) What type (e.g. artic 3+2, 8 wheeled rigid) and maximum gross vehicle weight of vehicle would you use for each load? (please state if it is not a vehicle in your fleet)

c) What price would you charge for each load assuming you allow no discount for transporting three loads?

	10 tonnes	20 tonnes	23 tonnes
Cost			
Type and weight of vehicle			
Price			
Would you prefer to subcontract these loads?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

A34

Instead of peas, suppose the cargo were changed to
i)__costly precision tools__ (retail value £1500 per tonne)
and ii)__cheap news print__ (retail value £100 per tonne).
Again, how much would it cost, what vehicles would be used
and what price would you charge, assuming all the other
conditions of the job opportunity to be the same? i.e. load
to Newcastle for delivery on Friday with backloads
available.

	10 tonnes	20 tonnes	23 tonnes
__Cost__ i) precision tools			
ii) newsprint			
__Type and weight of vehicle__ i) precision tools			
ii) newsprint			
__Price__ i) precision tools			
ii) newsprint			

QUESTION 3

Instead of delivery on Friday, suppose the customer wanted
the peas delivered on Wednesday (tomorrow) but the peas
are only available for loading at 4p.m today i.e. it is now
an urgent load. What would you now charge assuming all the
other conditions of the original job opportunity to be the
same? i.e. peas to Newcastle with backloads available.

	10 tonnes	20 tonnes	23 tonnes
Price			
Would you prefer to subcontract these loads?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

QUESTION 4

Instead of your firm being in a relatively slack period, suppose you had ample work for the week. What would you charge now assuming the other conditions of the original job opportunity to be the same? i.e. peas to Newcastle with backloads available.

	10 tonnes	20 tonnes	23 tonnes
Price	.		
Would you prefer to subcontract these loads?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

QUESTION 5

Instead of taking three loads to Newcastle, suppose the customer had only one load of 20 tonnes to be taken i) 100 miles ii) 400 miles iii) 450 miles. How much would it cost, what vehicles would you use and what would you charge for this load? Assume that the backload price on the 100 mile trip was £100 but that all the other conditions of the original job opportunity to be the same? i.e. peas for delivery on Friday with backloads available.

	100 miles	400 miles	450 miles
Cost (20 tonne load)			
Type and weight of vehicle used			
Price			

QUESTION 6

Instead of the customer being new, suppose it was a regular customer whose work accounts for 35% of your business. What would you charge assuming all the other conditions of the original job opportunity to be the same? i.e. peas to Newcastle for delivery on Friday with backloads available.

	10 tonnes peas	20 tonnes peas	23 tonnes peas
Price			

QUESTION 7

Instead of being able to get backloads, suppose no
backloads are available. What would you now charge assuming
all the other conditions of the original job opportunity to
be the same?

Price	10 tonnes	20 tonnes	23 tonnes
Would you prefer to subcontract these loads?	YES☐ NO☐	YES☐ NO☐	YES☐ NO☐

QUESTION 8

Suppose you anticipate the traffic being very heavy and the
trip taking 2 hours longer than usual. How much would it
cost and what would you charge assuming all the other
conditions of the original job opportunity to be the same?
i.e. peas to Newcastle for delivery on Friday with backloads
available.

	10 tonnes	20 tonnes	23 tonnes
Cost			
Price			
Would you prefer to subcontract these loads?	YES☐ NO☐	YES☐ NO☐	YES☐ NO☐

QUESTION 9

Instead of 10, 20 and 23 tonnes of peas, suppose the cargos were bulky and were i) one load measuring 12m by 4m by 2m of toilet rolls and ii)one load measuring 12m by 4m by 2m of expensive paper. How much would it cost, what would you charge and what type and weight of vehicle would you use for these loads assuming all the other conditions of the original job opportunity were the same? i.e. loads to Newcastle for delivery on Friday with backloads available.

	Toilet rolls	Televisions
Cost		
Type and weight of vehicle		
Price		

QUESTION 10

It has been said that market rates for transport are low at present and that rates do not reflect true costs or allow a big enough profit. If you could forget about the market, what would you consider a fair price for the job as specified in the original job opportunity? i.e. peas to Newcastle for delivery on Friday with backload available.

	10 tonnes peas	20 tonnes peas	23 tonnes peas
Price			

QUESTION 11

If the new customer started to haggle, what would be the absolute minimum you would accept for the original job?

	10 tonnes peas	20 tonnes peas	23 tonnes peas
Price			

If you wanted to minimise costs for the original job, what types and weights of vehicles would you like to use <u>if you could choose any vehicles you wanted</u> (not necessarily vehicles in your own fleet) and what difference would you expect it to make to costs and prices for the job?

	10 tonnes	20 tonnes	23 tonnes
Type and weight of preferred vehicle			
Expected cost using these vehicles			
Expected price using these vehicles			

COSTING AND PRICING SIMULATION

INSTRUCTIONS

Please do the following costing and pricing simulation as realistically as possible. Do not attempt to answer the questions as you think I would like them to be answered, but assume that you were costing and pricing a real job.

The simulation involves answering a set of 8 questions based on an imaginary job opportunity. Each question changes one of the conditions of the original job opportunity and asks you to recalculate your answers taking into account this change. You may find that you give the same answer to more than one question; do not worry about this.

May I once again remind you that all information will be treated in the strictest confidence.

JOB OPPORTUNITY

It is Tuesday and your firm is in a relatively slack period. A new customer asks you to transport three loads of _____ weighing 10 tonnes, 20 tonnes and 23 tonnes to Newcastle Upon Tyne for delivery on Friday. You know it will be impossible to obtain backloads.

QUESTION 1

a) How much would it cost you to transport each load to its destination assuming you could find no other goods to send with the 10 tonne load?

b) What type (e.g. artic 3+2, 8 wheeled rigid) and maximum gross vehicle weight of vehicle would you use for each load? (please state if it is not a vehicle in your fleet)

c) If transport is a profit centre in your firm, what would you charge your firm or your customer (please specify which) assuming you allow no discount for transporting three loads?

	10 tonnes	20 tonnes	23 tonnes
Cost			
Type and weight of vehicle			
Price			

QUESTION 2 (FOR FIRMS WHERE TRANSPORT IS A PROFIT CENTRE
ONLY)

Instead of delivery on Friday, suppose the customer
wanted the loads delivered on Wednesday (tomorrow) but the
goods will only be available for loading at 4 p.m. today
i.e. it is now an urgent load. What would you now charge
assuming all the other conditions of the original job
opportunity to be the same? i.e. loads to Newcastle.

	10 tonnes	20 tonnes	23 tonnes
Price			
Would you prefer to use hired transport for these loads?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

QUESTION 3 (FOR FIRMS WHERE TRANSPORT IS A COST CENTRE
ONLY)

Instead of your firm being in a relatively slack period,
suppose you had ample work for the week. What would you
charge now assuming the other conditions of the original job
opportunity to be the same? i.e. loads to Newcastle.

	10 tonnes	20 tonnes	23 tonnes
Price			
Would you prefer to use hired transport for these loads?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

QUESTION 4

Instead of taking three loads to Newcastle, suppose the customer wanted only one load of 20 tonnes to be taken i) 100 miles ii) 400 miles iii) 450 miles. How much would it cost, what vehicles would you use and what would you charge for this load (if transport is a profit centre) assuming all the other conditions of the original job opportunity to be the same? i.e. loads for delivery on Friday.

	100 miles	400 miles	450 miles
Cost (20 tonne load)			
Type and weight of vehicle used			
Price			
Would you prefer to use hired transport for these loads?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

QUESTION 5 (FOR FIRMS WHERE TRANSPORT IS A PROFIT CENTRE ONLY)

Instead of the customer being new, suppose it was a regular customer who accounts for 10% of the market for your product. What would you charge assuming all the other conditions of the original job opportunity to be the same? i.e. loads to Newcastle for delivery on Friday.

	10 tonnes	20 tonnes	23 tonnes
Price			

QUESTION 6 (FOR FIRMS WHERE TRANSPORT IS A PROFIT CENTRE ONLY)

Suppose you were able to get a backload from Newcastle for each vehicle for which you would receive £250 per vehicle. How much would you now charge assuming all the other conditions of the original job opportunity to be the same?

	10 tonnes	20 tonnes	23 tonnes
Price			

QUESTION 7

Suppose you anticipate the traffic being very heavy and the trip taking 2 hours longer than usual. How much would it cost and what would you charge (if transport is a profit centre) assuming all the other conditions of the original job opportunity to be the same? i.e. loads to Newcastle for delivery on Friday.

	10 tonnes	20 tonnes	23 tonnes
Cost			
Price			
Would you prefer to use hired transport for these loads?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

QUESTION 8

It has been said that market rates for transport are low at present and that rates do not reflect true costs or allow a big enough profit. If you could forget about the market, what would you consider a fair price for the job as specified in the original job opportunity? i.e. loads to Newcastle for delivery on Friday.

	10 tonnes	20 tonnes	23 tonnes
Price			

QUESTION 9

If you wanted to minimise costs for the original job, what types and weights of vehicles would you like to use if you could choose any vehicles you wanted (not necessarily vehicles in your own fleet) and what difference would you expect it to make to costs and prices for the job?

	10 tonnes	20 tonnes	23 tonnes
Type and weight of preferred vehicle			
Expected cost using these vehicles			
Expected price using these vehicles			

THANKYOU FOR DOING THIS SIMULATION

HIRE OR REWARD QUESTIONNAIRE
(SMALL SCALE SURVEY)

SECTION 1

1.1 When you are pricing a haulage job, you may take into account your competitors in the haulage industry. How many firms, if any, do you view as being
a) in direct competition?   . . . .

b) in fairly direct competition?   . . . .

IF YOU ANSWERED NONE TO BOTH PARTS OF THE QUESTION PLEASE GO TO QUESTION 1.3.

1.2 If you have any direct or fairly direct competitors, how similar to you are the two firms you regard as being in closest competition, in terms of the following. (If you have only one competitor, please complete section 1.2a only).

	VERY SIMILAR	FAIRLY SIMILAR	NOT VERY SIMILAR	QUITE DIFFERENT	VERY DIFFERENT	DONT KNOW
a) M 1 (most ect competitor) e (number of icles)						
es of vehicles d (e.g. artic , rigid tipper)						
es of activity er than transport g. warehousing)						
graphical ation.						
gth of time in business						
2 e						
es of vehicle d.						
es of activity						
graphical ation						
gth of time business						

1.3 What percentage of your average weekly work (tonne_mileage) is accounted for by

	0%	1-9%	10-19%	20-29%	30-39%	40-49%	50-59%	60% or more
Customers with whom you have written contracts to transport goods								
Customers for whom you work regularly (i.e. more than once a week) as their only transport provider.								
Regular customers who also use other transport providers.								
Non regular customers.								

1.4 What is your opinion of the level of outside competition?

Extremely intense ☐ , very intense ☐ , fairly intense ☐

Not very intense ☐ , Non existent ☐ .

PLEASE TICK ONE BOX

1.5 What is your opinion of the present financial state of the road haulage industry in general?

Extremely healthy ☐ , Very healthy ☐ , Fairly healthy. ☐

Fairly depressed. ☐ Very depressed ☐ .

PLEASE TICK ONE BOX

1.6 In the next twelve months, do you think your business will

Improve ☐ , Get worse ☐ , Stay as it is ☐ .

PLEASE TICK ONE BOX

1.7   What is your opinion of the present state of the general U.K. economy?

Extremely healthy ☐, Very healthy ☐, Fairly healthy, ☐

Fairly depressed ☐, Very depressed ☐.

PLEASE TICK ONE BOX

SECTION 2

2.1 Do you try to find out haulage rates charged by other hauliers?

YES ☐, NO ☐.

IF YOU ANSWER NO, PLEASE GO TO QUESTION 2.6

2.2 Do you monitor haulage rates in general and/or haulage rates charged by specific hauliers?

Haulage rates in general ☐, Specific hauliers rates ☐.

YOU MAY TICK MORE THAN ONE BOX

2.3 How do you find out information on haulage rates charged by others?

a) by phoning other hauliers and asking them directly?   ☐

b) by pretending to be a customer and asking for a quote? ☐

c) noted when subcontracting?   ☐

d) by asking drivers to obtain information?   ☐

e) by talking to other hauliers at meetings (e.g. RHA)?   ☐

f) from published cost tables?   ☐

g) customers tell you?   ☐

h) other, please specify.........................   ☐

PLEASE TICK APPROPRIATE BOXES

2.4 Is information on other hauliers rates monitored

    a) as a matter of policy?

    b) only when they are brought to your attention?

    c) only when you specifically want information on prices?

    d) other, please specify.........................

2.5 Why do you monitor other hauliers rates?

    a) out of interest?

    b) to keep your prices in line with others?

    c) to convince customers of your competitiveness?

    d) other, please specify..................

2.6 Is information on other hauliers costs monitored?

    YES ☐ , NO ☐ .

    <u>IF YOU ANSWERED NO, PLEASE GO TO QUESTION 2.8.</u>

2.7 How is information on costs gathered?
    a) by talking to other hauliers at meetings (e.g. RHA)?

    b) from published cost tables?

    c) from trade magazines (other than published cost tables)?

    d) from vehicle manufacturers?

    e) from conversations with drivers and mechanics?

    f) other, please specify..................

PLEASE TICK APPROPRIATE BOXES

SECTION 3

3.1 Which of the following do you think is most appropriate to your firm?

    a) We are <u>always</u> looking for the best ways of operating and improving efficiency.

    b) We like to keep one step ahead by <u>periodically</u> considering different ways of operating

    c) If opportunities arise we will consider them, but otherwise we operate out of habit unless something goes wrong.

    d) We only look at alternative ways of operating when something goes wrong.

a ☐ , b ☐ , c ☐ , d ☐ .

SECTION 4

4.1 What are the MAIN objectives of your firm?

a) to maximise profits

b) to make an acceptable level of profits

c) to maximise turnover

d) to achieve an acceptable turnover

e) to maximise growth

f) to achieve an acceptable level of growth

g) to maximise vehicle utilisation

h) to have an acceptable level of vehicle utilisation

i) to maximise return on capital

j) to achieve an acceptable return on capital

k) to provide a good service

l) to provide an acceptable level of income

m) other, please specify....................

PLEASE TICK APPROPRIATE BOXES

4.2

	level of profits	level of turnover	rate of growth	vehicle utilisation	return on capital
a) Do you have annual targets for these objectives? (not necessarily written)	YES ☐	YES ☐	YES ☐	YES ☐	YES ☐

IF YOU TICK NONE OF
THE BOXES, PLEASE
GO TO QUESTION 4.3

b) Are there written targets for these objectives?	YES ☐	YES ☐	YES ☐	YES ☐	YES ☐

c) How often are
targets revised?
e.g. annually ....

4.3

	CAPITAL EXPENDITURE	CURRENT EXPENDITURE
a) Is expenditure controlled by written budgets?	YES, all ☐ YES, some ☐ , NO ☐ If YES some, please specify which......	YES, all ☐ , YES, some ☐ , NO ☐ If YES some, please specify which....... ....

············IF YOU ANSWERED NO TO BOTH, PLEASE GO TO QUESTION 4.4

b) How frequently are budgets
revised? (e.g. annually)   ....

c) When new budgets are
calculated are they done
from scratch?   YES ☐ , NO ☐ .   YES ☐ , NO ☐ .

d) When new budgets are
calculated are they
updated by a certain
percentage over the
previous one?   YES ☐ , NO ☐ .   YES ☐ , NO ☐ .

If you answered NO to both c) and d), how are budgets calculated?

....

PLEASE TICK APPROPRIATE BOXES

4.4 Do you try

a) to minimise all costs?

b) to keep costs within budgets?

c) to keep costs at an acceptable level?

d) other, please specify................

PLEASE
TICK
ONE
BOX

4.5 If your depot is part of a larger company,

a) What performance measures do head office monitor (e.g. tonnage carried per week, capital expenditure, none).
Please specify...................................

b) Are written comparisons of performance levels made with other depots in the country?

YES ☐ . NO ☐ .

IF YOU ANSWERED NO PLEASE GO TO QUESTION 4.6

c) What performance measures are compared with those of other depots? Please state how often for each. (e.g. tonnage caried weekly).

....

....

....

4.6 In the past year have you used an outside consultant other than a tachograph analyst?

YES ☐ . NO ☐ .

If so, please specify what for.........................

SECTION 5

5.1   Is this the only depot in your firm?   YES ☐ , NO ☐

   IF YOU ANSWERED YES, PLEASE GO TO QUESTION 5.3

5.2 a) How many depots does your firm have? ....

   b) Are they located nationally or just in the South
      West?

               Nationally ☐ , Just in the south West ☐ .

   c) Are they locally or centrally controlled?

               Locally ☐ , Nationally ☐ , Both ☐ .

   d) Is this depot head office?   YES ☐ , NO ☐ .

   e) Does head office do any of the following? (your
depot if this is head office)

      i) set your performance targets

      ii) set your budgets

      iii) analyse your performance data

      iv) specify the number of vehicles you may have

      v) specify the number of people you may employ

      vi) specify the make of vehicle you may have

      vii) specify the kind of costing you do

5.3   Is your depot split formally into departments?

               YES ☐ , NO ☐ .

      If YES, how many departments are there?
               ....

5.4 How many vehicles over 3.5 tonnes GVW are there

   a) in your fleet   ....

   b) in the total company fleet   ....

PLEASE TICK APPROPRIATE BOXES

5.5 How many employees are there

    a) in this depot   ....

    b) in the company   ....

SECTION 6

6.1 Is your firm at least partly owner_managed?

    YES ☐ , NO ☐ .

6.2 If YES, a) does more than one member of the owning family work here (in any capacity?

    YES ☐   NO ☐ .

    b) does the owner manager work here full time?

    YES ☐ .   NO ☐ .

6.3 What kind of firm is your firm?

    a) a private unlimited company?

    b) a private limited company?

    c) a partnership?

    d) a cooperative?

    e) a public limited company?

    f) other, please specify......................

6.4 what was last years annual turnover?

    up to £1/2 million ☐ . £1/2 m but less than £1m ☐ .

    £1m but less than 2m ☐ . £2 m but less than £5m ☐ .

    £5m or more ☐

6.5 Did your firm make a net profit last year?
    YES ☐ , NO ☐ .

    If so, please state how much   ....

PLEASE TICK ·APPROPRIATE BOXES

SECTION 7

Thankyou for completing the above questions relating to the firm. Now to finish, please would you fill in the personal details below. May I remind you that all the information will be treated in the strictest confidence.

7.1 At what age did you leave secondary education?
. . . .

7.2 How old are you now?

less than 20 ☐ , 20-29 ☐ , 30-39 ☐ , 40-49 ☐ ,
50-59 ☐ , 60 or more ☐ .

7.3 What educational qualifications do you have?
a) C.S.E.s

b) 'O' levels

c) 'A' levels

d) degree

e) matriculation

f) Higher School Certificate

g) none

h) other, please specify. . . . .

7.4 What transport qualifications do you have?
a) C.P.C

b) M.C.I.T.

c) F.C.I.T.

d) none

e) other, please specify. . . . .

7.5 How long have you been working in your present position in this firm?

. . . .

7.6 How long have you been with this firm? . . . .

7.7 How long have you been in the transport business?
. . . .

THANK YOU VERY MUCH FOR COMPLETING THIS
QUESTIONNAIRE.

OWN ACCOUNT QUESTIONNAIRE

SECTION 1

1.1 Do you use public hauliers, rail or contract hire vehicles to transport any of your finished goods?

	YES	NO
public hauliers	☐	☐
rail	☐	☐
contract hire	☐	☐

1.2 If so, approximately what percentage of your total annual tonnage goes by

	less than 10%	10%-19%	20%-29%	30%-39%	40%-49%	50% or more
public haulier						
rail						
contract hire						

1.3 What is your opinion of the level of outside competition?

Extremely intense ☐, very intense ☐, fairly intense ☐

Not very intense ☐, Non existent ☐.

PLEASE TICK ONE BOX

1.4 What is your opinion of the present financial state of the road haulage industry in general?

Extremely healthy ☐, Very healthy ☐, Fairly healthy, ☐

Fairly depressed, ☐ Very depressed ☐.

PLEASE TICK ONE BOX

1.5 In the next twelve months, do you think your business will

Improve ☐, Get worse ☐, Stay as it is ☐.

PLEASE TICK ONE BOX

1.6 What is your opinion of the present state of the general U.K. economy?

Extremely healthy☐, Very healthy☐, Fairly healthy,☐

Fairly depressed☐, Very depressed☐.

PLEASE TICK ONE BOX

1.7 Approximately what percentage of the total costs of your main product is accounted for by transport?

less than 1%☐, 1%-4%☐, 5%-9%☐, 10%-14%☐, 15%-19%☐,

20% or more☐.

1.8 What is the average annual output of your main product in tonnes?

....

1.9 What are the three main reasons for running your own fleet of lorries?

1..

2..

3..

SECTION 2

2.1 Do you try to find out haulage rates charged by other transport providers?

YES☐, NO☐.

IF YOU ANSWER NO, PLEASE GO TO QUESTION 2.5

2.2 How do you find out information on haulage rates charged by others?

a) trade magazines (other than cost tables)?

b) by asking drivers to obtain information?

c) by talking to other hauliers at meetings (e.g. RHA, FTA)?

d) from published cost tables?

e) customers tell you?

f) other, please specify ....

PLEASE TICK APPROPRIATE BOXES

2.3 Is information on other hauliers rates monitored

    a) as a matter of policy?

    b) only when they are brought to your attention?

    c) only when you specifically want information on prices?

     d) other, please specify.............................

2.4 Why do you monitor other hauliers rates?

    a) out of interest?

    b) to keep your prices in line with others?

    c) to convince customers of your competitiveness?

    d) other, please specify........................

2.5 Is information on other hauliers costs monitored?

    YES ☐ , NO ☐.

    IF YOU ANSWERED NO, PLEASE GO TO QUESTION 2.7.

2.6 How is information on costs gathered?

    a) by talking to other hauliers at meetings (e.g. RHA, FTA)?

    b) from published cost tables?

    c) from trade magazines (other than published cost tables)?

    d) from vehicle manufacturers?

    e) from conversations with drivers and mechanics?

    f) other, please specify........................

PLEASE TICK APPROPRIATE BOXES

A56

2.7 Does your firm receive the following publications and do you regularly read those received?

	Yes, they are both received and read regularly	Yes, they are received but not read regularly	No, they are not received
a) Commercial Motor?	☐	☐	☐
b) Motor Transport?	☐	☐	☐
c) Transport?	☐	☐	☐
d) Roadway?	☐	☐	☐
e) Freight?	☐	☐	☐
f) Trucking?	☐	☐	☐
g) Transportation Journal	☐	☐	☐
h) Focus	☐	☐	☐
i) other transport publications please specify......	☐	☐	☐

2.8 Apart from reading trade magazines, do you keep up with the transport news in any of the following ways?

	YES	NO
a) attend courses?	☐	☐
b) attend conferences?	☐	☐
c) attend FTA, RHA or other transport organisation meetings?	☐	☐
d) talk to vehicle manufacturers?	☐	☐
e) talk to drivers about their experiences?	☐	☐
f) other, please specify....................	☐	☐

PLEASE TICK APPROPRIATE BOXES

SECTION 3

3.1 Which of the following do you think is most appropriate to your firm?

    a) We are _always_ looking for the best ways of operating and improving efficiency.

    b) We like to keep one step ahead by _periodically_ considering different ways of operating

    c) If opportunities arise we will consider them, but otherwise we operate out of habit unless something goes wrong.

    d) We only look at alternative ways of operating when something goes wrong.

a ☐ . b ☐ . c ☐ , d ☐ .

SECTION 4

4.1 What are the MAIN objectives of your firm?

a) to maximise profits

b) to make an acceptable level of profits

c) to maximise turnover

d) to achieve an acceptable turnover

e) to maximise growth

f) to achieve an acceptable level of growth

g) to maximise vehicle utilisation

h) to have an acceptable level of vehicle utilisation

i) to maximise return on capital

j) to achieve an acceptable return on capital

k) to provide a good service

l) to provide an acceptable level of income

m) other, please specify.....................

PLEASE TICK APPROPRIATE BOXES

	level of profits	level of turnover	rate of growth	vehicle utilisation	return on capital
Do you have annual targets for these objectives?	YES ☐	YES ☐	YES ☐	YES ☐	YES ☐

t necessarily
tten)
YOU TICK NONE OF
 BOXES, PLEASE
TO QUESTION 4.3

Are there written gets for these ectives?	YES ☐	YES ☐	YES ☐	YES ☐	YES ☐

How often are
gets revised?
 annually ....

	CAPITAL EXPENDITURE	CURRENT EXPENDITURE
Is expenditure controlled written budgets?	YES, all ☐ YES, some ☐ , NO ☐ If YES some, please specify which......	YES, all ☐ , YES, some ☐ , NO ☐ If YES some, please specify which....... ....

 ----IF YOU ANSWERED NO TO BOTH, PLEASE GO TO QUESTION 4.4

ow frequently are budgets
sed? (e.g. annually)   ....

When new budgets are
ulated are they done
 scratch?   YES ☐ , NO ☐ .   YES ☐ , NO ☐ .

en new budgets are
ulated are they
ted by a certain
entage over the
ious one?   YES ☐ , NO ☐ .   YES ☐ , NO ☐ .

ou answered NO to both c) and d), how are budgets calculated?

....

PLEASE TICK APPROPRIATE BOXES

4.4 Do you try

a) to minimise all costs?

b) to keep costs within budgets?

c) to keep costs at an acceptable level?

d) other, please specify................

PLEASE
TICK
ONE
BOX

4.5 If your depot is part of a larger company,

a) What performance measures do head office monitor (e.g. tonnage carried per week, capital expenditure, none). Please specify.................................

b) Are written comparisons of performance levels made with other depots in the country?

YES ☐ . NO ☐ .

IF YOU ANSWERED NO PLEASE GO TO QUESTION 4.6

c) What performance measures are compared with those of other depots? Please state how often for each. (e.g. tonnage caried weekly).

....

....

....

4.6 In the past year have you used an outside consultant other than a tachograph analyst?

YES ☐ . NO ☐ .

If so, please specify what for.........................

SECTION 5

5.1 Is this the only depot in your firm?   YES ☐ . NO ☐

      IF YOU ANSWERED YES, PLEASE GO TO QUESTION 5.3

5.2 a) How many depots does your firm have? ....

   b) Are they located nationally or just in the South West?

        Nationally ☐ . Just in the south West ☐ .

   c) Are they locally or centrally controlled?

        Locally ☐ . Nationally ☐ . Both ☐ .

   d) Is this depot head office?   YES ☐ . NO ☐ .

   e) Does head office do any of the following? (your depot if this is head office)

      i) set your performance targets

      ii) set your budgets

      iii) analyse your performance data

      iv) specify the number of vehicles you may have

      v) specify the number of people you may employ

      vi) specify the make of vehicle you may have

      vii) specify the kind of costing you do

5.3 Is your depot split formally into departments?

      YES ☐ . NO ☐ .

   If YES, how many departments are there?
      ....

5.4 How many vehicles over 3.5 tonnes GVW are there

   a) in your fleet   ....

   b) in the total company fleet   ....

PLEASE TICK APPROPRIATE BOXES

5.5 How many employees are there

    a) in this depot ....

    b) in the company ....

SECTION 6

6.1 Is your firm at least partly owner_managed?

             YES ☐ , NO ☐ .

6.2 If YES. a) does more than one member of the owning family work here (in any capacity?

             YES ☐   NO ☐ .

    b) does the owner manager work here full time?

             YES ☐ .   NO ☐ .

6.3 What kind of firm is your firm?

    a) a private unlimited company?

    b) a private limited company?

    c) a partnership?

    d) a cooperative?

    e) a public limited company?

    f) other, please specify.....................

6.4 what was last years annual turnover?

    up to £1/2 million ☐ . £1/2 m but less than £1m ☐ .

    £1m but less than 2m ☐ . £2 m but less than £5m ☐ .

    £5m or more ☐

6.5 Did your firm make a net profit last year?
          YES ☐ . NO ☐ .

    If so, please state how much   ....

PLEASE TICK APPROPRIATE BOXES

SECTION 7

Thankyou for completing the above questions relating to the firm. Now to finish, please would you fill in the personal details below. May I remind you that all the information will be treated in the strictest confidence.

7.1 At what age did you leave secondary education?
. . . .

7.2 How old are you now?

less than 20 ☐ , 20-29 ☐ , 30-39 ☐ , 40-49 ☐ .

50-59 ☐ ,60 or more ☐ .

7.3 What educational qualifications do you have?
a) C.S.E.s

b) 'O' levels

c) 'A' levels

d) degree

e) matriculation

f) Higher School Certificate

g) none

h) other, please specify. . . . .

7.4 What transport qualifications do you have?
a) C.P.C

b) M.C.I.T.

c) F.C.I.T.

d) none

e) other, please specify. . . . .

7.5 How long have you been working in your present position in this firm?

. . . .

7.6 How long have you been with this firm? . . . .

7.7 How long have you been in the transport business?
. . . .

THANK YOU VERY MUCH FOR COMPLETING THIS
QUESTIONNAIRE.

APPENDIX 4C

COVERING LETTER SENT WITH THE QEDCP AND
QUESTIONNAIRE TO THE 18 OPERATORS

Dear ....

Following my visit to .... last year when I
spent some time observing your operations, I am now at the
stage when I would very much like to take up your kind offer
of further assistance. To this end, I enclose a
questionnaire and costing/pricing simulation. I would
appreciate it if you yourself would complete the
questionnaire and would pass the simulation on to the
person/people who normally deal with the costing and pricing
for them to complete.

As you may recall, I am researching the economic
consequences of heavy goods vehicles in the South West; a
major project funded by Devon Education Authority and
supported by both the RHA and the FTA. Having obtained a
good understanding of the operations of hauliers from my
visits, I am now trying to relate actual transport costs
and prices to factors within the firm. This will enable
predictions to be made of transport cost and price changes
resulting from proposed changes in legislation, and will,

therefore, be of great benefit to the haulage industry.

I can assure you that the information you give will be treated in the strictest confidence and that it will not be possible to identify individual hauliers in any reports. The sample of 18 makes it very important that ALL firms complete the exercise; failure to do so by just one firm could put the whole project in jeopardy. I would also ask you to return it within a week if possible.

A copy of the results of the exercise will be sent to you and you may, of course, find that completion of the exercise is of value to yourselves.

Should you have any queries or problems concerning the exercise, please do not hesitate to contact me at the above number.

Thankyou in anticipation

Yours sincerely

Sharon Hallett (Research Assistant)

REGRESSIONS FROM SMALL SCALE SURVEY

THE REGRESSION EQUATION IS
C1 = 345 - 143 C4 - 55.5 C5 - 25.5 C6 - 95.8 C7 + 78.7 C8 - 42.5 C9
- 101 C10 - 7.1 C11

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	345.00	51.11	6.75
C4	-143.45	21.96	-6.53
C5	-55.45	12.48	-4.44
C6	-25.45	12.48	-2.04
C7	-95.82	24.82	-3.86
C8	78.73	17.44	4.51
C9	-42.55	17.86	-2.38
C10	-100.91	11.56	-8.73
C11	-7.09	11.56	-0.61

S = 9.035

R-SQUARED = 99.0 PERCENT
R-SQUARED = 94.9 PERCENT, ADJUSTED FOR D.F.
Continue?

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	8	15983.3	1997.9
RESIDUAL	2	163.3	81.6
TOTAL	10	16146.5	

FURTHER ANALYSIS OF VARIANCE
SS EXPLAINED BY EACH VARIABLE WHEN ENTERED IN THE ORDER GIVEN

DUE TO	DF	SS
REGRESSION	8	15983.3
C4	1	7573.1
C5	1	3.1
C6	1	786.8
C7	1	17.7
C8	1	913.3
C9	1	172.1
C10	1	6134.1
C11	1	-0.7

DURBIN-WATSON STATISTIC = 1.16

MTB >

DURBIN-WATSON STATISTIC = 1.10

MTB

```
MTB > regress c1 / c4-c10

THE REGRESSION EQUATION IS
C1 = 319 - 134 C4 - 50.3 C5 - 20.3 C6 - 84.0 C7 + 74.0 C8 - 34.7 C9
        - 99.3 C10

                                    ST. DEV.       T-RATIO =
COLUMN          COEFFICIENT         OF COEF.       COEF/S.D.
                319.00              25.43          12.54
C4              -134.00             13.93          -9.62
C5              -50.333             8.262          -6.09
C6              -20.333             8.262          -2.46
C7              -84.00             13.93          -6.03
C8              74.00              13.93           5.31
C9              -34.67             11.05          -3.14
C10             -99.33             10.03          -9.90

S = 8.042

R-SQUARED = 96.8 PERCENT
R-SQUARED = 96.0 PERCENT, ADJUSTED FOR D.F.
Continue?

C8              74.00              13.93           5.31
C9              -34.67             11.05          -3.14
C10             -99.33             10.03          -9.90

S = 8.042

R-SQUARED = 98.8 PERCENT
R-SQUARED = 96.0 PERCENT, ADJUSTED FOR D.F.
```

THE REGRESSION EQUATION IS
C3 = 213 - 75.4 C4 + 6.6 C5 - 36.4 C6 - 89.5 C7 + 62.2 C8 - 48.6 C9
       - 45.7 C10 - 18.3 C11

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	213.0	177.7	1.20
C4	-75.36	76.36	-0.99
C5	6.64	43.40	0.15
C6	-36.36	43.40	-0.84
C7	-89.45	85.29	-1.04
C8	62.18	60.64	1.03
C9	-48.64	62.11	-0.78
C10	-45.73	40.18	-1.14
C11	-18.27	40.18	-0.45

S = 31.41

R-SQUARED = 76.0 PERCENT
R-SQUARED = 0.0 PERCENT, ADJUSTED FOR D.F.
Continue?

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	8	6255.1	781.9
RESIDUAL	2	1973.5	986.7
TOTAL	10	8228.5	

FURTHER ANALYSIS OF VARIANCE
SS EXPLAINED BY EACH VARIABLE WHEN ENTERED IN THE ORDER GIVEN

DUE TO	DF	SS
REGRESSION	8	6255.1
C4	1	453.8
C5	1	3361.7
C6	1	30.9
C7	1	1050.8
C8	1	0.3
C9	1	77.5
C10	1	1116.1
C11	1	744.0

DURBIN WATSON STATISTIC = 1.96

MTB

R-SQUARED = 99.0 PERCENT
R-SQUARED = 94.9 PERCENT, ADJUSTED FOR D.F.
Continue?

APPENDIX 6

QUESTIONNAIRE FOR LARGE SCALE SURVEY

PLYMOUTH POLYTECHNIC

DEPARTMENT OF SHIPPING & TRANSPORT

1. Are the vehicles in your firm used

    (a) Wholly or mainly for hire or reward?

    (b) Wholly or mainly for own account?

    (c) Wholly or mainly for contract hire/lease to other companies?

    1 PLEASE TICK

    2 ONE BOX

    3

2. How many vehicles of at least 3.5 tonnes GVW are based

    (a) At this depot? _____

    (b) In the total company fleet? _____

3. Do you consider your firm to be

    (a) International? 1

    (b) National? 2 PLEASE TICK

    (c) Regional? 3 ONE BOX

4. Do the owners of your firm play an active part in its management?

    YES [ ] 1   NO [ ] 2   PLEASE TICK ONE BOX

5. What do you consider to be the MAIN objectives of your firm

	Maximise	Acceptable level	
Profits	1	7	
Turnover	2	8	PLEASE TICK
Growth	3	9	APPROPRIATE
Return on capital	4	10	BOXES
Service to customers	5	11	
Income	6	12	

6. Over the past financial year how would you describe your company's overall performance on its major objectives?

    (a) Very successful 1

    (b) Fairly successful 2

    (c) Fairly unsuccessful 3   PLEASE TICK ONE BOX

    (d) Very unsuccessful 4

7. Does your firm have

	YES	NO	
(a) Written budgets for transport expenditure?	1	2	PLEASE TICK
(b) Written targets for transport objectives?	3	4	APPROPRIATE BOXES

P.T.O.

A69

1.

8. Does your firm attempt to find out

   (a) the transport costs of other transport providers?

   (b) the transport rates of other transport providers?

YES   NO

☐ 1   ☐ 2

☐ 3   ☐ 4

PLEASE TICK
APPROPRIATE
BOXES

51 ☐☒ 52

☐☒

53   54

---

9. **MULTI DEPOT FIRMS ONLY**

Does head office analyse depot performance data (e.g. costs per tonne of goods transported, total tonnage carried, etc.)?

YES ☐ 1   NO ☐ 2   PLEASE TICK
ONE BOX

☐☒

55   56

---

10. **FOR MAINLY OWN ACCOUNT FIRMS ONLY**

How many companies, if any, make goods which you consider to be in direct competition with yours? _____

What is your firm's main product? _____

FOR MAINLY HIRE OR REWARD FIRMS ONLY

How many companies, if any, do you consider to be in direct competition with yours? _____

☐☐☒

57   59

☐☐☒

60   62

☐☐☒

63   65

---

11. Would you describe the level of outside competition faced by your firm as being

  (a) Extremely intense   ☐ 1
  (b) Very intense   ☐ 2
  (c) Fairly intense   ☐ 3   PLEASE TICK ONE BOX
  (d) Not very intense   ☐ 4
  (e) Non existent   ☐ 5

☐☒

66   67

---

12. How would you describe the present state of the UK economy as far as your company is concerned?

  (a) Extremely healthy   ☐ 1
  (b) Very healthy   ☐ 2   PLEASE TICK ONE BOX
  (c) Fairly healthy   ☐ 3
  (d) Fairly depressed   ☐ 4
  (e) Very depressed   ☐ 5

☐☒

68   69

13.(a) Does your firm calculate its transport costs?

YES ☐ 1   NO ☐ 2   PLEASE TICK
ONE BOX

☐☒

70   71

IF 'NO' PLEASE GO TO QUESTION 15.

2. A70

13.(b) When calculating your transport costs, which of the following do you take into account as a separate cost item and how often?

	Daily	Weekly	Monthly	Quarterly	Annually
Licences					
Insurance					
Depreciation					
Garage wages					
Drivers' wages					
Overheads					
Vehicle hire					
Interest					
Inflation					
Equipment					
Fuel					
Oil					
Tyres					
Maintenance					
Accidents					
	1	2	3	4	5

PLEASE TICK APPROPRIATE BOXES

72 / 87 ... 86 / 100

14. Do you calculate your transport costs on

(a) an individual vehicle basis? 1

(b) a per weight category of vehicle basis (e.g. all 16 tonners combined) 2

PLEASE TICK
ONE BOX

(c) a per type of vehicle basis (e.g. all articulated vehicles combined) 3

(d) an aggregate basis (costs of all vehicles together) 4

(e) other, please specify 5

101 102

15.(a) Please state the GVW and carrying capacity of the largest vehicle under your control (excluding abnormal load carrying vehicles)

GVW _____ .

Carrying capacity _____

103 ... 10

106 ... 10

(b) How much would it cost you to transport a full load to a destination 100 miles from your depot and return empty (i.e. 200 mile round trip) using this vehicle?

_____

109 ... 112

Would this cost be for a full load by weight or volume?

Weight 1   Volume 2

113 114

P.T.O.

A71

3.

17.   What educational qualifications do you have?

(a) C.S.E's   ☐ 1
(b) 'O' levels   ☐ 2
(c) 'A' levels   ☐ 3   Please tick appropriate
(d) Degree   ☐ 4   box/boxes
(e) Matriculation   ☐ 5
(f) Higher School Certificate ☐ 6
(g) None   ☐ 7
(h) Other (please specify) ☒ 8

115 ☐☒ 116

18.   In which county is your depot based?

(a) Avon   ☐ 1
(b) Cornwall   ☐ 2
(c) Devon   ☐ 3
(d) Gloucestershire ☐ 4   Please tick one box
(e) Somerset   ☐ 5
(f) Wiltshire   ☐ 6
(g) Dorset   ☐ 7
(h) Hereford & Worcester ☐ 8
(i) Salop   ☐ 9
(j) Staffordshire   ☐ 10
(k) Warwickshire   ☐ 11
(l) West Midlands   ☐ 12
(m) Other (please specify) ☒
                     13   14

117 ☐☒ 119

Comments:

120 ☐☒ 122

123 ☐☒ 125

126 ☐☒ 128

THANK YOU FOR YOUR HELP

4.
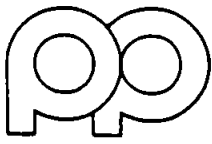
Plymouth Polytechnic

Director: R.F.M. Robbins, BSc. PhD. CChem. FRSC

Drake Circus. Plymouth. Devon. PL4 8AA.
Phone. (0752) 21312   Telex. 45423 PPLRC G

Faculty of Maritime Studies
Dean: Professor D.H. Moreby. Ex.C.. Ph.D.. FNI.
Phone: (0752) 264664

Faculty Officer: Mrs. Suzanne Tolan
Phone: (0752) 264673

Reply to: Sharon Hallett (Ext. 5219)

Our ref:

Your ref:

Date: February 1986

Dear Sir,

It would be greatly appreciated if you would spare a few minutes to complete the enclosed questionnaire which forms part of a major research project done in association with the FTA and RHA into the costing procedures of transport operators.

At present government policy makers and academics have little knowledge of the costing methods used by transport operators and thus must make important decisions based on unrepresentative data. This study hopes to go some way towards rectifying this situation.

The accuracy of the results depends on the number of completed questionnaires returned, so please return the completed questionnaire as promptly as possible. Whether your company is large or small, your reply is of equal importance.

I can assure you that all information will be treated in the strictest confidence and that your identity will remain totally anonymous.

A prepaid envelope is enclosed for your reply.

If you have any questions concerning the questionnaire, please do not hesitate to contact me at the above number.

Thank you for your help.

Yours faithfully,

S. L. Hallett.

Mrs. S. Hallett
Research Assistant

A73

REGRESSION ANALYSIS IN FULL

The regression equation is

$61 = 35.4 + 14.2\ a\ -\ 7.24\ b\ +\ 6.54\ c\ +\ 0.780\ d\ -\ 0.11\ e\ +\ 1.07\ f$
$-\ 4.52\ g\ -\ 2.60\ h\ +\ 15.8\ i\ +\ 14.8\ j\ +\ 3.67\ k\ +\ 9.15\ l$

12 cases used 160 cases contain missing values

Predictor	Coef	Stdev	t-ratio
Constant	35.364	9.704	3.64
a	14.185	4.395	3.23
b	-7.236	7.667	-0.94
c	6.537	3.883	1.68
d	0.7802	0.1839	4.24
e	-0.109	3.648	-0.03
f	1.069	4.038	0.26
g	-4.524	4.289	-1.05
h	-2.602	4.004	-0.65
i	15.800	5.151	3.07
j	14.805	4.118	3.59
k	3.6743	0.3052	12.04
l	9.154	4.686	1.95

$= 31.81$ R-sq = 61.0% R-sq(adj) = 59.4%

Continue?

Continue? y

Analysis of Variance

SOURCE	DF	SS	MS
Regression	12	472424	39369
Error	299	302523	1012
Total	311	774946	

SOURCE	DF	SEQ SS
a	1	105078
b	1	21833
c	1	1704
d	1	95353
e	1	557
f	1	3584
g	1	123
h	1	3219
i	1	37384
j	1	49629
k	1	150096
l	1	3861

STEPWISE REGRESSION ANALYSIS

STEP	1	2	3	4	5	6
CONSTANT	49.97	49.33	44.73	32.38	30.62	30.41
k	4.94	4.52	4.05	3.96	3.68	3.63
T-RATIO	17.44	15.98	13.87	13.81	12.25	12.14
d		0.95	0.90	0.84	0.88	0.75
T-RATIO		5.21	5.05	4.85	5.08	4.17
j			19.4	17.4	15.4	14.5
T-RATIO			4.71	4.28	3.77	3.56
i				18.3	19.7	17.0
T-RATIO				3.70	4.02	3.39
a					11.7	14.5
T-RATIO					2.92	3.47
l						10.0
T-RATIO						2.23
S	35.5	34.1	33.0	32.3	31.9	31.7
R-SQ	49.52	53.61	56.73	58.58	59.70	60.34

Continue?

RESIDUAL PLOTS

standardised
3.0+   residuals

C71

```
     3.0+   residuals
                                                        *
        -
C71     -                                          *
        -     2        *        *        *      *      *              2              2
        -        *                                           3    2            2
    1.5+       * *                       * *                * *          * *
        -     * 2      2 2      2 2 *              6       2      2 *
        -     * 3 * * *    2 4                     2                    2
        -     2        2 3 4              * 4              3 2      *    * *  *
        -   3 * * *    3   6         *  3 2 *      7 3 *              2
    0.0+  * * 4    *    2 3 8      *    4 2    * * 5 *        4   2
        - * 2 3 * * 2 2 * 8  * * *      * * *  4 3 *              4
        - * 5     *    2   4 * *        * 2 2    3 2      * 2
        - * *        3 * * 5           * *    *  4 3 2    * *
        - 2 3        3   2 *              5    *              *
   -1.5+ 2        2 *              *    *    * 2    * * 2
        -                  * *                          2
        -   *      *      *           *    *    3        *
        -                              *                *
```
----------+---------+---------+---------+---------+---------+-------C4
         5.0   10.0   15.0   20.0   25.0
                                      vehicle carrying capacity
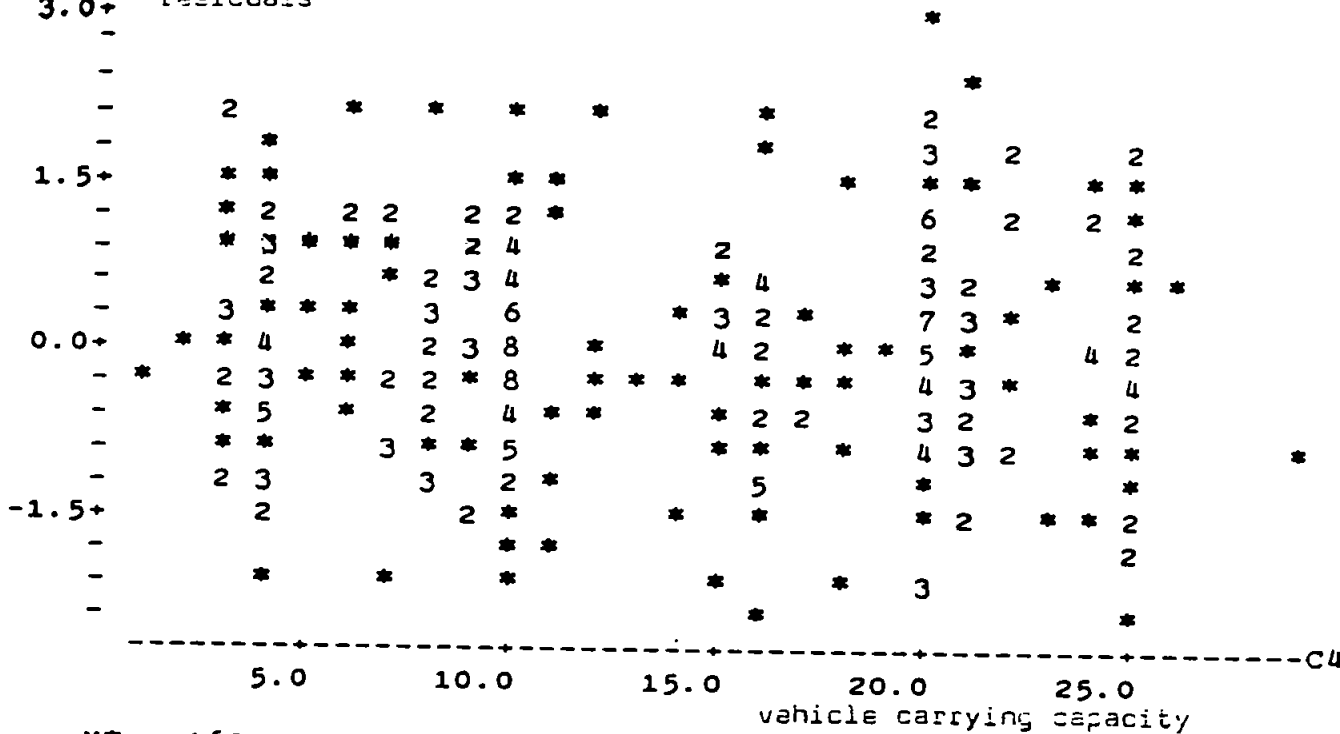
N* = 160

MTB >

standardised
residuals

```
    3.0+        *
       -
C71    -          *
       -   25* *
       -   2*2 *   *    * *
   1.5+   3* * ** *   *
       - 2854**     *        *
       - +5**                   * *
       - *44722* 2*          *
       - *+5422**** **      *      *
   0.0+ *++54**          *
       - *+87 3 **2       *
       - 978***     *
       - ++ **    **              *
       - 2+23   *
  -1.5+  632 2                          *
       -  * 2             *
       -  232           *
       -     *
```
----+---------+---------+---------+---------+---------+---------+------C3
   0   20   40   60   80   100
                                      size of firm

MTB >   N* = 160

A76

standardised
residuals

```
 3.0+  *
    -
 1  -                                                    *
    -                                                    9
    - 4                                                  5
 1.5+ 3                                                  6
    - +                                                  +
    - 6                                                  +
    - +                                                  +
    - +                                                  +
 0.0+ +                                                  +
    - +                                                  +
    - +                                                  +
    - +                                                  +
    - +                                                  +
    - +                                                  8
-1.5+ 3                                                  +
    -                                                    4
    - *                                                  7
    -                                                    2
    +---------+---------+---------+---------+---------+------C62
   0.00      0.20      0.40      0.60      0.80      1.00
```
geographical coverage

N* = 160

standardised
residuals

```
 3.0+  *
    -
 1  - *
    - 7                                                  2
    - 5                                                  4
 1.5+ 6                                                  3
    - +                                                  7
    - +                                                  4
    - +                                                  +
    - +                                                  +
 0.0+ +                                                  +
    - +                                                  +
    - +                                                  5
    - +                                                  8
    - +                                                  5
-1.5+ 9                                                  5
    - 3                                                  *
    - 5                                                  3
    -                                                    2
    +---------+---------+---------+---------+---------+------C70
   0.00      0.20      0.40      0.60      0.80      1.00
```
use of budgets

standardised
residuals

```
  3.0+  *
     -
C71  -
     -  4                                              *
     -  4                                              5
  1.5+  6                                              5
     -  +                                              3
     -  9                                              +
     -  9                                              +
     -  +                                              +
  0.0+  +                                              +
     -  +                                              +
     -  +                                              +
     -  +                                              +
     -  +                                              6
 -1.5+  5                                              9
     -  *                                              3
     -  3                                              5
     -  *                                              *
     +--------+--------+--------+--------+--------+------C66
     0.00    0.20     0.40     0.60     0.80     1.00
       N* = 160                              type of firm
TB >
```
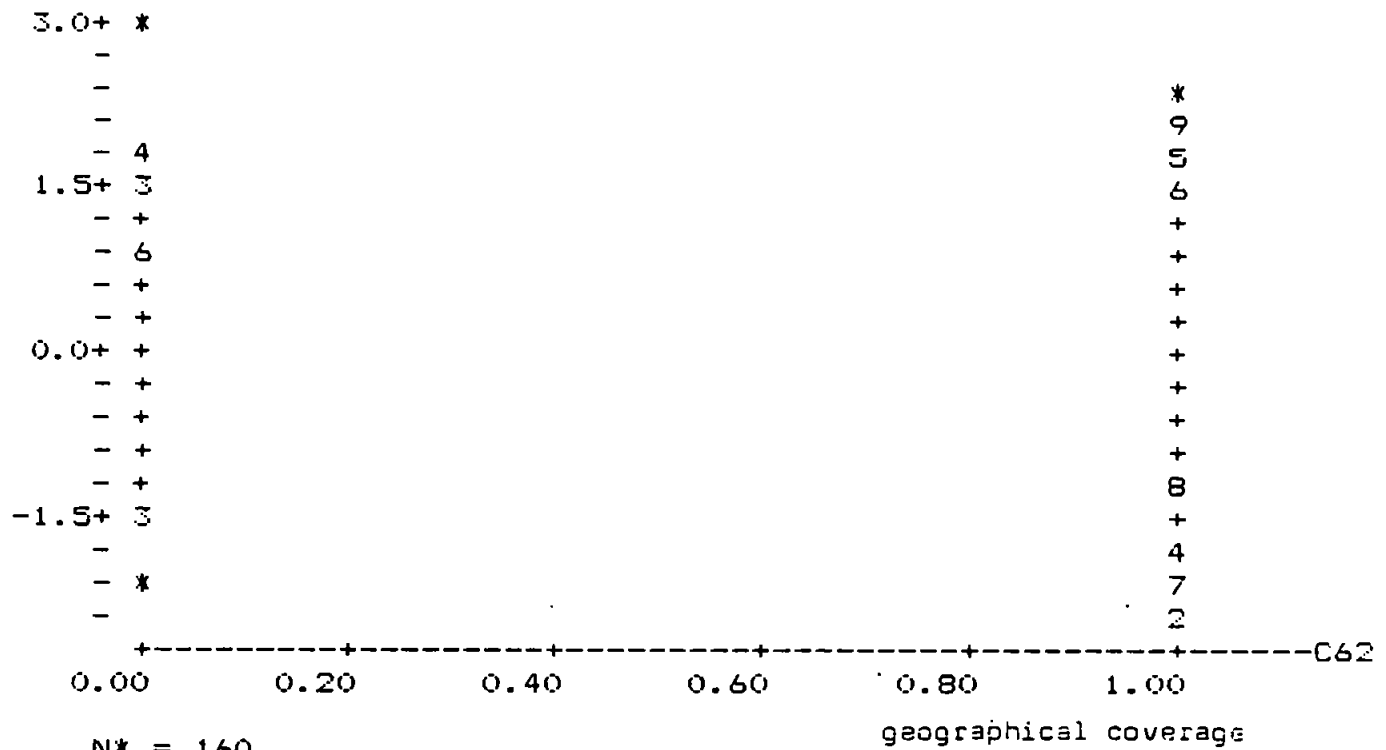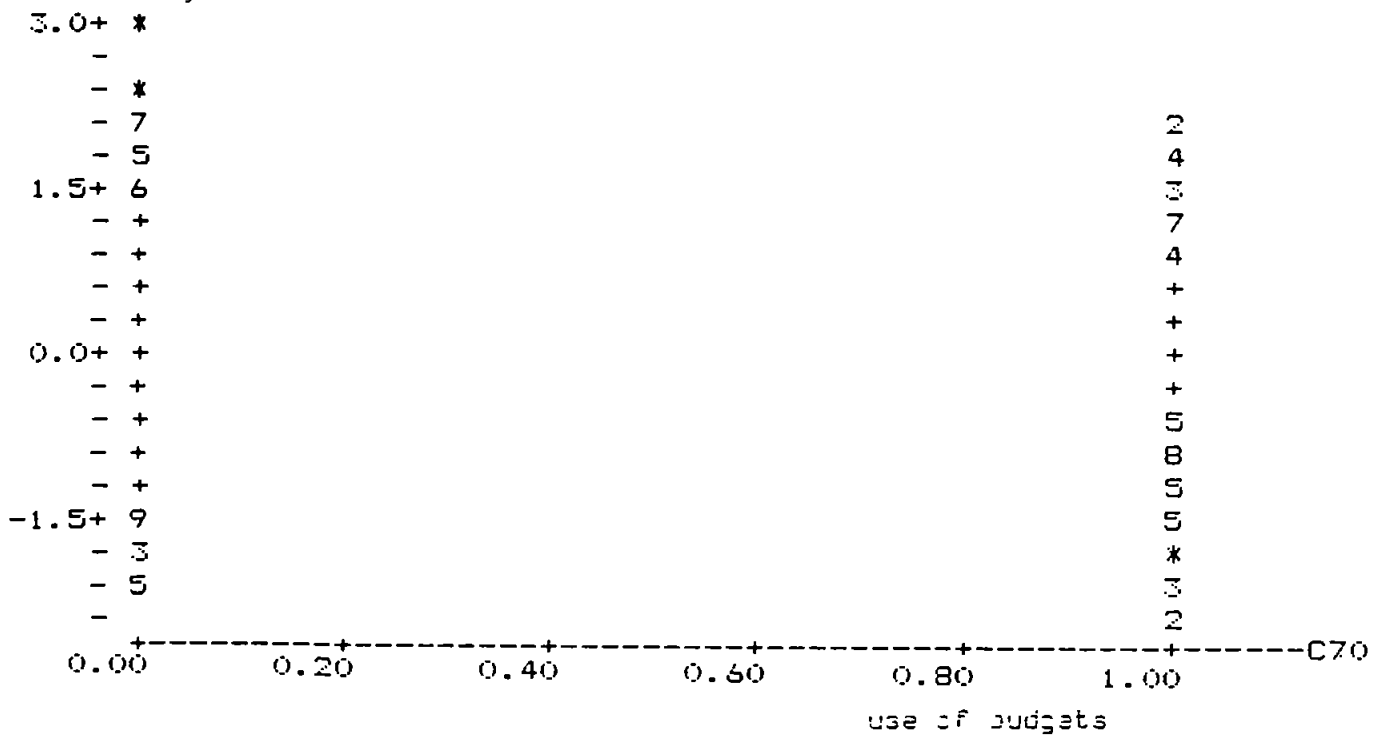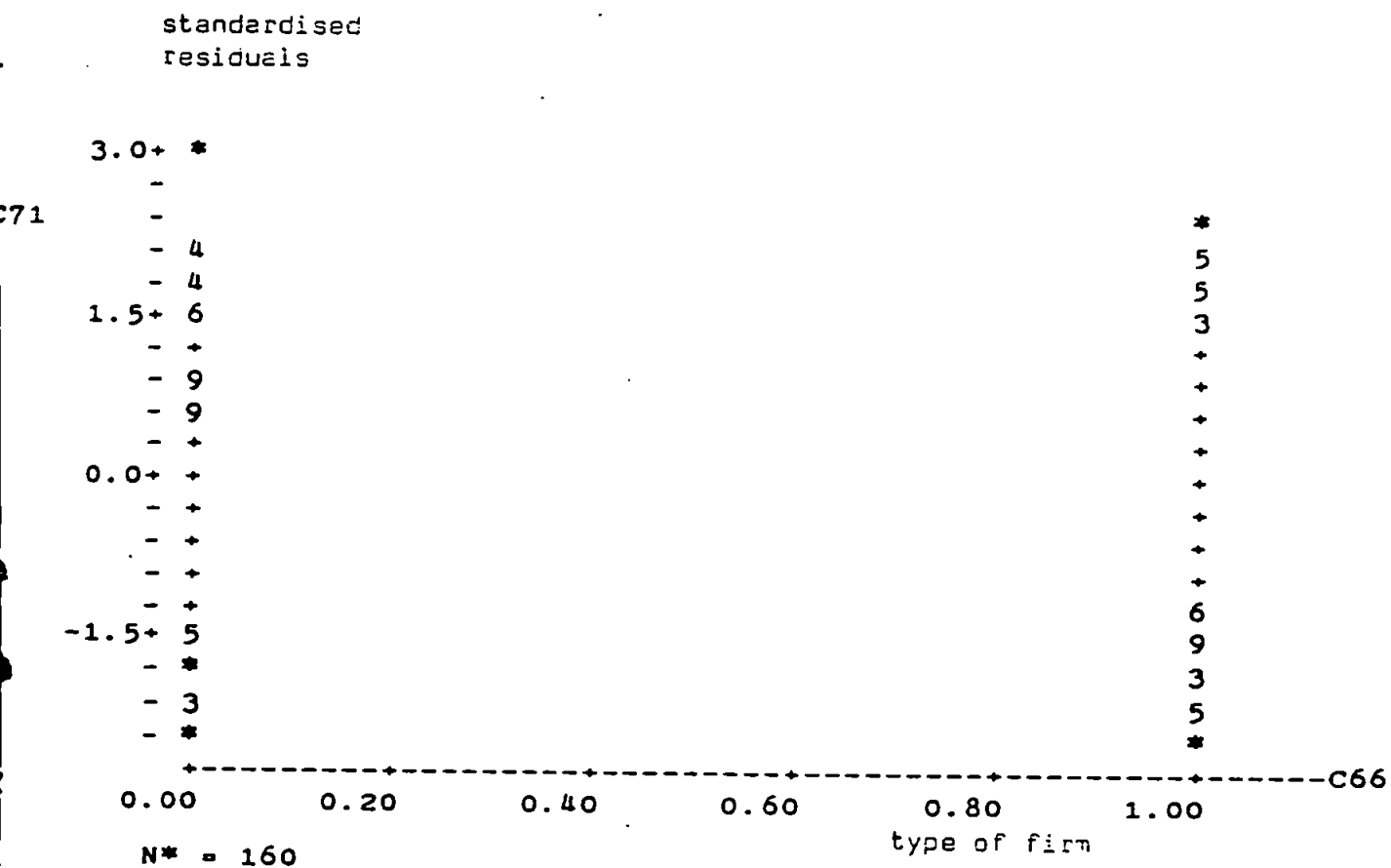
CORRELATION MATRIX

Continue? n
MTB > correlate c66 c67 c64 c3 c55 c57 c56 c58 c68 c62 c48 c70

	a	b	c	d	e	f	g	h
a	0.188							
b	0.042	-0.027						
c	0.060	-0.110	-0.044					
d	-0.016	0.028	-0.080	-0.020				
e	-0.030	-0.017	-0.028	0.089	-0.006			
f	-0.123	-0.172	0.113	0.071	0.024	0.011		
g	0.128	-0.109	0.076	0.188	-0.020	0.107	0.089	
h	0.004	-0.119	0.103	0.142	-0.014	0.135	0.093	0.187
i	0.276	-0.006	-0.059	0.170	-0.019	0.076	-0.018	0.146
j	0.377	-0.043	0.007	0.300	0.049	0.078	0.020	0.250
k	-0.252	-0.215	0.108	0.331	0.052	0.101	0.171	0.162

	i	j	k
i	0.213		
j	0.175	0.389	
k	0.294	0.190	0.118