THE ROLE OF FREIGHT RATES IN THE RACE BETWEEN ROAD AND RAIL IN SOUTH AFRICA: A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

J.L. Erero & Jan van Heerden[1]
Department of Economics, University of Pretoria

Abstract

This paper is presenting the role of freight rates in the choice between road and rail in South Africa. Rates are a difficult subject. There are more constraints about the costing procedures that underlie the rates and about the kind of percentage mark-ups that are involved in different types of movement. The costs involved in a transport movement obviously form the basis of freight rates. These costs can be broadly divided into fixed costs, mainly incurred at terminals and depots, and variable costs, which arise through the actual line, haul movement. They are often known as per hour and per mile costs respectively. It is difficult to draw any valid conclusions on rates, simply because we not only do not know what the vast majority of them are, but also they may vary between customers over the same route.

Rimmer studied the rates charged by freight forwarders in considerable depth[2], but was unable to find any recognizable pattern. The only way in which the principle of "rates generally increasing at a decreasing rate[3]" could be applied was to group destinations into major cities, and consider other minor cities as an isolated case. However, there seems to be very little real value in trying to generalize even on the published rates because of their lack of correspondence with reality. A based 1998 "Social Accounting Matrix (SAM)"was constructed and ORANI-JL, a General Equilibrium Model of the South African Economy was developed based on the generic version of the model, ORANI-G, an applied general equilibrium (AGE) model of the Australian economy, which, is designed for expository purposes and for adaptation to other countries. Our description of the freight rates and the model is presented in this paper by using the GEMPACK system to discover the influence of the road freight and rail freight in the South African Economy.

JEL Classifications: C68, D58, L92, R40
Keywords: Freight rates, freight forwarders, Computable General Equilibrium modeling, rail and road freight

---

[1] Mr Erero is PhD student, Department of Economics, University of Pretoria, while Jan van Heerden is Professor and the Head of the Department of Economics at the same institution. Views expressed are those of the authors and do not reflect those of any institution they may be involved with. All remaining errors are sole responsibility of the authors though.

[2] Rimmer , P.J., Freight Forwarding in Australia, Research School of Pacific Studies, Department of Human Geography Publication HG/4, A.N.U., Canberra, 1970.

[3] Golledge, R.G., "Methods in Australian Trade and Transportation Studies" in G.H. Drury and M.I. Logan eds, Studies in Australian Geography, pp. 303-327, Heinemann Educational Australia Pty Ltd, Melbourne, 1968.

1. INTRODUCTION

"Regulation of road and rail transport in South Africa is the prerogative of the Department of transport to exercise its prerogative through ownership of rail systems and control the legislation of road passenger transport and through regulation of road haulage" (Kolsen 1968, 132). This quote by Kolsen (1968) shows that the transport system was marked by regulation until 1989[4]. Legislative regulation is thus confined to road transport. The railways cannot be said to be regulated in the strict meaning of the term, but their development and administration have always been the result of political decisions, so that a considerable degree of constraint has in fact been exerted. Regulation of road transport began in the 1930's when hauliers first began to be a threat to the established railways systems. The government saw the growth of unrestricted competition between the two modes as an attack on the financial stability of the railways, and obviously wanted to protect the railways from the loss of traffic and necessary rate reductions caused by an increase in the number of road hauliers.

As mentioned above, the underlying philosophy of road transport regulation is protection of the railways, but as Bland (1972) has pointed out, it cannot be said that the regulatory system has succeeded in this objective. Railway deficits are far from acceptable. Despite this, most parties involved still want to see some sort of regulation, mainly because free competition can only exist where both modes are meeting their full proper costs or at least being placed on an equal footing in the matter of subsidies. To effect this situation is almost impossible, entailing as it does the calculation of proper costs and decisions as to the level of government subsidy[5]. The main objective of road transport regulation was to secure freight for the railways. Government progressive deregulation of the road transport has resulted in unrestricted competition by the road and rail modes of transportation. Even though economic controls are used, there is now considerable freedom for short haul road operations. Nevertheless, for all trips the amount levied depends upon the commodity, the weight and the distance concerned. Goods are classified as to their suitability for carriage by rail.

Much prominence has been given in legislation to the objective of co-ordination of transport facilities so as to secure the maximum economic benefit as the ultimate transport problem[6]. In this context it means the integration of services by various means, such as using standardized equipment or terminals, or planning joint timetables or services, with the aim of avoiding wasteful duplication. However, it could also mean the organization of activities of various sectors of the transport industry so that transport services are supplied at the least possible cost in terms of the real resources that are consumed in providing them. "Co-ordination in this economic sense implies a division of transport functions between the various modes based on the relative social costs each incurs in providing a particular service, so that in aggregate, transport services are provided at least cost to the community."[7] This incorporates proposals similar to Bland's and perhaps indicates the type of philosophy

---

4 H.M. Kolsen, The Economics and Control of Road –Rail Competition 1968, p.132

5 H.A. Bland, "Australian Transport", July-August, 1972, pp. 36-43.

6 W. Roots, "Road Transport in Western Australia," September-October, 1972, pp. 32-35.

7 R.R. Hirst, "Transport Regulation in Australia," Melbourne University, Department of Civil Engineering, Transport Section, Melbourne, 1968, p. 2.

that may underlie future regulations. The diversity of regulations currently in force to solve the common problems of the shifting balance of technical and economic advantage between the various transport modes implies that an obviously best solution has yet to be found.[8]

However, when we look at the situation in South Africa, two major aspects are still problematic. Firstly we hear of demands by carriers for some controls with regards to remuneration for freight drivers. Presently, the remuneration seems to be arbitrary. Some drivers have fixed wages, while others have a small proportion of remuneration composed of wages and the remaining being made put of bonuses. Secondly, as Bland pointed out, true competition cannot take place given that both road and rail are not bearing the true costs of hauling goods due to a lack of transparency in rate setting. This, in spite of the fact that most of the Department of Transport recommendations on road transport regulation were aimed at simplifying the licensing system.[9]

Furthermore, the advent of true free competition may not be a pipe dream. The problem is one of ascertaining each mode's full proper costs, which is essentially a problem of measurement and should not be insuperable. A great deal of study will be necessary to achieve some reasonably precise measurement of road track costs and the external costs incurred by road freight vehicles. This should make it possible to eventually achieve free and equitable competition between modes by charging the correct costs in all cases, although results will obviously not appear overnight.[10]

In the past, the credo of the rail service focused on servicing industrial centers characterized by mass production as countries industrialized. In fact many urban centers sprang up around the railway line networks. With limited road network, heavy equipment and indeed passengers relied heavily on rail network for mobility. As such this sector strived. However, with the advent of globalization, characterized by competitiveness and customer focus, and the fact that new urban areas sprang up in areas not serviced by the rail network, the use of road network for freight forwarding increasingly gained prominence to the detriment of the former sector. This situation has been exacerbated by the expansion of the road network. The situation faced by the rail sector is a challenge to government's objective to keep it vibrant.

Traditionally, the South African rail industry has been focused on servicing the two most important railway clients, which were Spoornet and the mining companies of South Africa. Export levels have been low (Agosin 1999), although South Africa has the capability to plan and scope railway projects, manufacture rolling stock and signaling equipment. Spoornet has world-class technologies. The New Plan for Africa Development (NEPAD) will include major rail infrastructure projects[11]. South Africa has the skills, equipment and services to offer to these projects, which could result in an increase of exports in South African railway equipment (Aero and Tedder 2002:1).

---

[8] Kolsen, "Commercial Vehicle Operations' Guide to Taxes," March-April, 1973, p. 16.

[9] Bland, Reflections on Land Transport in Victoria, Government Printer, Melbourne, 1971-72.

[10] J.H.E Taplin 'Economic Problem of Transport Development," ANZAAS 44TH Congress, Section 5, Engineering, Sydney, 1972, p. 9.

[11] Survey on Spoornet: The Editor, The Sunday Times, Business Times, July 8 2001.

The rail and road transport industries give South Africa the opportunity to increase its economic portfolio. It also offers South Africa the possibility to stay in the global race for world technological development and provide technically skilled jobs. These industries could assist South Africa in making the African Renaissance a reality. The road and rail transport industries of South Africa need more research because a limited research previously undertaken.

Rate setting is a highly controversial matter. The transport operators do not want to discuss them because they do not want their competitors to know what they charge, the transport users do not want to discuss them because of possible repercussions from competitors, their forwarding agents and anyone interested in the costs behind the prices their products demand. Scheduled rates for both road and rail are freely available, but only about 20% of all goods carried are actually charged this price[12].

However, there is more frankness about the costing procedures that underlie the rates and about the kind of percentage mark-ups that are involved in different types of movement. This therefore forms the basis of this section, together with a brief discussion of the theory that lies behind rate setting. There is no way of knowing exactly how much it will cost to move a certain type of freight from A to B, except to ask the carriers, and even then the answer you get will depend on many factors such as relative bargaining strengths, the volume and regularity of shipments, the carrier's work load and the type of equipment that will be required. The case of Ford Motor Company in South Africa will be studied in detail in this paper.

The freight industry rate setting in the rail and road sub-sector is not transparent although there is a presumption that costing of hauling is based on preset rates. It is possible to draw a distinction in terms of the costs faced by firm size on the one hand and the regularity of the use of the freight services by firms on the other hand. A schedule rate is applied to irregular customers, while quotation rates are applied to regular customers. This implies that the former face reduced costs of hauling their goods relative to the latter firms. Firm size is a big factor in influencing the rates with large firms being well positioned to negotiate better prices. Some are even able to dictate their own terms with regards to rates. However, smaller firms struggle to negotiate for lower rates and as a result face high hauling costs.

It is striking to notice the role played by freight forwarders[13], which seems to be growing in importance. These are able to negotiate for better prices and can help alleviate the costs faced particularly by smaller firms. The question now is how can the services of the freight forwarders be harnessed to reduce transportation costs faced by smaller firms and hopefully begin to bring transparency in the rate setting?.

Industry rate structures will be discussed for road and rail, but the freight forwarders will be dealt with separately as they use both the road and rail modes and have more complex costing and rating procedures. Differences between the Provinces will be noted where applicable, but special mention will be made of Western Cape and

[12] This information is taken from personal interview with Spoornet Manager

[13] The freight forwarders are unique in the transport industry in that they use all the modes, although mainly road and rail, and are able to quote rates for any type of movement.

KwaZulu-Natal where freight rates between these two provinces are affected by the necessity to use shipping[14].

2. TRANSPORT SERVICE SECTOR IN SOUTH AFRICA

Transport services are the means of moving physical goods and labour within and across countries. Transport sector as such impacts directly on the cost of trade internally and externally. A less costly and efficient transport system increases opportunities for trade and specialisation, which in turn will improve the welfare of South Africans[15].

The rise of global and regional production networks calls for an efficient transport infrastructure to enable South Africa to become integrated into the network. The global networks require rapid and "Just-in-Time" movement of components of the final product to be able to exploit the available comparative advantages of different locations. If a country does not provide the minimum standards of transport infrastructure, it would be excluded from the participation in the network.

2.1. ROAD TRANSPORT SERVICES

The South African National Roads Agency Limited is an independent, statutory company registered in terms of the Companies Act and its mandate is to develop, maintain and manage the country's national road network.

The roads transportation sector faces a number of challenges. Firstly, the road network is inadequate resulting in a lack of accessibility and affordability of public transport by almost 13 percent of the South African population. Secondly, safety and security, which is evident in all the sub sectors discussed in this paper, except the airport services, is a concern due to overloaded tracks and unsafe vehicles contributing to a high incidence of accidents, and violence in the taxi ranks.

2.2. RAILWAY TRANSPORT SERVICES

Commuter rail services

Commuter rail is the essential mode of public transport to many South Africans and it mainly serves people at lower income levels because of its affordability. According to SA Rail Commuter Corporation (SARCC) Annual report for 2003, over two million passengers use commuter rail service to and from work daily.

SA Rail Commuter Corporation control SA's rail network. Metrorail, a division of Transnet Ltd, is responsible for operating the metropolitan commuter system in seven regions: Durban, Cape Town, Port Elizabeth, Pretoria, East London, Berlin (Uitenhage) and Wits Greater Johannesburg. It is contracted to provide this service to the SARCC, which owns the rolling stock and most of the infrastructure.

---

[14] Peronal interview with South Africa Rail Commuter Corporation (SARCC)

[15] This section draws on material from Kolsen, op.cit., pp. 132-146.

The aim of government is to make commuter rail the preferred mode of public transport, through provision of safe and pleasant rail-commuting environment. There are, however, a number of problems/challenges faced by the sector. These include aging rolling stock which affects the reliability of the service; increased management costs and reduced availability of coaches due to fare evasion and vandalism, for instance, over 30 coaches were burnt in various staging yards during 2002/2003.

Container rail services

Spoornet provides goods, container services as well as long distance passenger services. The main products transports are general freight, coal, iron and ore. The railway transport sub sector faces strong competition from the road sub sector in addition to rolling stock failure and foreign exchange risks especially the Spoornet international section.

3. THE THEORETICAL STRUCTURE OF FREIGHT RATES

The costs involved in a transport movement obviously form the basis of freight rates. These costs can be broadly divided into fixed costs, mainly incurred at terminals and depots, and variable costs, which arise through the actual line, haul movement. They are often known as per hour and per mile costs respectively. The fixed costs are the same for all shipments of a given size and type, irrespective of the length of haul, whereas the variable costs vary with the distance covered. Since terminal costs are high relative to costs per mile of moving goods over the line, they make for relatively high rates on short hauls. As length of haul increases, the influence of terminal costs becomes progressively less important and net importance of line-haul costs increases.

This gives the principal reason for the fact that freight rates generally increase at a decreasing rate. In other words, they tend to taper over distance.[16] The rate curve is initially steep because of the influence of constant terminal costs, whereas bulk-weight and distance are the prime factors in cost of movement, which influences the degree of tapering. Although many other factors, such as fragility, perish ability, packing and liability for loss also affect rating; the factors cited are the most significant.

The cost of service and value of services fix the two extremities of the range within which a rate is determined.[17] Within this range, freight rates are almost always closer to the lower than to the upper limit, on account of competition among carriers, anxiety that all available traffic should move, a desire to induce more traffic and even a wish to give the user a fair deal. If cost of service is the dominant factor, rates are determined by operating costs, traffic densities and length of haul. If what the traffic will bear is the basis, there is no logical procedure for allocating rates; the practice is simply to charge so as not to reduce business substantially.

Two basic methods are employed to fix rates – the schedule and the quotation. This occurs both in the road and rail sectors, though perhaps more so in the former where

---

[16] R.G. Golledge, "Methods in Australian Trade and Transportation Studies." In G.H Dury and M.I Logan, Studies in Australian Geography, pp.303-327.

[17] H.M. Kolsen, The Economics and Control of Road-Rail Competition, p. 132

any load over 2 tons is usually subject to a quoted rate. Even below this weight, only casual customers would be charged the scheduled rate, regular customers being offered a flat per parcel rate plus a delivery fee.[18] The railways special rates are usually negotiated on the basis of regular and reasonably large loadings, so the published rates could be used more than with road. However, the advent of increased road competition has led to an increasing number of special railway rates, so the two modes are becoming similar in this respect.

It is possible to express rates mathematically by means of equations.[19]
The method of fixing a scheduled rate is given by:-

$$R = (W \times La \times C) + P$$

Where R is the actual freight schedule recorded in Rand per kg,
W is the load in kg,
La is the distance factor,
C is the true average operating cost (line haul + feeder service, including Pick-up, delivery and terminal charges) for a perfect load in say Rand per tone mile
And P is profit before tax.

Quotation rates are derived from this equation in the following manner:-

$$T = La \times R \times W\,max / W$$

Where T is the transport cost to the consignor in Rand per tone mile,
La is the actual distance,
R is the actual freight rate in Rand per tone mile, (these rates would presume that trailer and/ or vans are loaded to maximum capacity and the feeders are loaded to practical capacity),

And W max / W is the tare factor which allows for effectiveness of space utilization of the carrier (this factor is allowed for by use of the 'cubic' tone, which for road and rail is usually 4 cu.m. per tone).

3.1. ROAD

The road transport industry is divided into local, intra-regions carriers and those who operate inter-provinces. The freight forwarders[20] have effectively created an oligopoly in the latter sector, so that even though there are many owners/ drivers operating between the major cities, they are generally either attached to one of the large forwarding companies, or at least obtain most of their loads from the latter's depots. These arrangements will be discussed below under the freight forwarding operation,

---

[18] P.J.Rimmer, Freight Forwarding in Australia, p. 108.

[19] Ibid. with terminology and equations from W.R. Blunden, R.H. Buchanan and D. Oedjoe, "Cost of Distribution," in R.H. Buchanan and C.G. Sinclair (eds), Costs and Economics of Australian Process Industries, pp.1301-1316.

[20] The freight forwarders are unique in the transport industry in that they use all the modes, although mainly road and rail, and are able to quote rates for any type of movement.

but it is worthwhile to note here that many of these itinerant drivers find themselves in financial difficulties because it is reasonably easy to pick up a load in Johannesburg and all other cities,[21] while it is not so easy to obtain backloading. The results of this is rate cutting to such an extent that costs are not even covered for the return journey. Hence the statistics that the road transport industry has headed the bankruptcy in the last four years (SARCC, 2003).

When examining the activities of road vehicle operators, it shows clearly that "as a general run, the road transport operator is singularly not well informed about his costs."[22] Thus he does not even know when his rate cutting is leading him into non-profitable operations.

In an attempt to alleviate this problem, the Department of Transport issues rate schedules, which are guidelines to operators showing what they should be charging if they wish to remain profitable. The difficulty seems to be that these rates form an umbrella rather than minimum, so all carriers are working on reduced profit margin. The larger, more sophisticated companies undertake detailed costings and so know when business is profitable or otherwise, but the vast majority of small operators are working "by the seat of their pants".

The published rates are calculated firstly on the basis of costings done by the Department of Transport and then amended through discussion with a number of large member companies who undertake to keep detailed costing. Obviously these will not all give the same answer, but if they are similar, an average is taken, or further investigation can be carried out if there are significantly different estimates for a particular cost item. The costs that have to be included are wages, payroll tax, workers' compensation, fuel, lubrication, tyres, repairs and maintenance, insurance, registration fees, road tax and other miscellaneous items. Every time a cost changes, for example, a pay rise is awarded or the price of petrol is increased, the effect on carriers is calculated and the rates altered if necessary. A rise in wage rates has very important effect on the transport industry, as 55-60 per cent of a local carrier's costs are for labour, and even in the inter-region trade, the figure is 30-35 per cent. If the price of petrol is increased by 20 cent a liter for instance, haulers' costs will rise by 4 Rand per mile, which is a significant amount.

As an example, the recommended rate[23] for the local cartage of goods in 5 tonne lots is R8.74 per tonne with a mileage allowance of between R1.7 and R1.5 per km, decreasing with distance. For cubic freight[24], the rates are R4.98 per cu.m. With a mileage charge of R1.5 or R1.4 per km. These rates are for dry goods and separate scales are published for refrigerated cargo (a surcharge of about 50% is added), containers (see Table 1), the hire of a vehicle (see Table 2), parcels (a flat per parcel rate is usually charged), furniture removals and all other types of cartage in which local haulers are engaged. Schedules for inter-province carriage are also produced and are used both by the itinerant drivers and by the freight forwarders as published rates.

---

[21] On average, there is 20% less road traffic from Johannesburg and Pretoria to Durban than vice versa, where the only freight to be found is taken from shipping and has to be carried at shipping rates.

[22] H.A. Bland, Report on Victorian Land Transport System, P.63.

[23] All rates quoted were supplied by the Spoornet

[24] Freight over 4 cu.m. per tonne is considered as cubic freight on road and rail.

Freight to Durban, Cape Town and East-London is costed on a cubic basis because of the sea transport involved. A shipment of 15 cu.m. to Durban costs R1170.64, to Cape Town, R1334.88 and to East London R1234.80. For every 0.02 cu.m. above this, the charge is R15.68, R17.74 and R16.46 respectively.

In stark contrast to the small road haulage firm, existing from day to day without knowing what their costs are, the larger firms have very sophisticated costing systems. Fixed costs and variable costs are determined for each vehicle and an average found for the various groups.

Table 1: Rates for the Local Cartage of Containers

Distance from JHB	Type of Container	Rate Rand
Up to 2 miles	20 ft	88.00
	40 ft	162.00
2-12 miles	20 ft	186.50
	40 ft	244.00
24-26 miles	20 ft	256.00
	40 ft	328.00

Source: *Spoornet*

Table 2: Rates for the Hire of Vehicles

Type of Vehicle	Cost per Hour Rand	Cost per Km Rand
Truck	100.00	13.10
Single axle semi-trailer	120.00	15.76
Tandem axle semi-trailer	130.35	18.75
Bogie-bogie semi-trailer	150.00	20.65

Source: Imperial Car & Commuter

The variable costs are used for control purposes, but can also be used in large jobs where a number of trucks will be needed. Overheads are apportioned into fixed costs for each group; so all costs are accounted for except non-essential items like directors' perquisites, which must obviously come out of profits. In this way, the company knows exactly what any job will cost, so a percentage can be added to this for profit and a quotation given. It is generally considered that a 20 per cent mark-up is reasonable and that anything less than 15 per cent is not worth doing, although there may be occasions, say if work is short or large, regular volumes are to be shipped, when this is not strictly adhered to. If loading and/ or unloading is involved, the rate is increased to cover this. However, it is extremely difficult to know exactly what this part of the operation costs as the work is likely to be spasmodic and some types of equipment take longer to do a job than others, but may involve a smaller capital investment. Thus this part of rate setting tends to be more of an educated guess than a scientific operation.

In the well-established part of the industry, there is no toting for business, as generally speaking all the customers know all the carriers and vice-versa. Someone who wants some goods moved will merely ask for a quotation and this may be negotiated upon. There is almost no rate cutting because once one person starts the practice, others will follow and a depression of the whole industry will result. The problem arises where someone gets together a pool of owner/ drivers. One of two things usually happens: either the drivers are put on a commission basis and tote for trade, involving rate cutting until they drive themselves out of business, or else the organizer fixes the rates and obtains the freight, but gives his drivers 25 per cent less than he is receiving, which eventually leads to the same result.

From the foregoing it should be obvious that no generalizations can be made on the subject of road rates as they are fixed to a large degree through the forces of supply and demand acting at any given time.

3.2. RAIL

The railways' rate structure originated in the days when they held a monopoly of the transport industry, at first because they were the only method of land transport and then, from the 1930's onwards, because they were protected through the Government's regulation of the emerging road haulage industry. Hence the rates were monopoly prices, based on the principle of charging what the traffic would bear. "At one time the railways were able, with this pricing policy, to maximize the volume of business they handled: traffic with inelastic demand was charged relatively high rates, and these subsidized business with high price elasticity of demand. [25]"

However, this is only possible in a monopoly situation. With competition, the demand elasticity for the lucrative traffic increases and ad valorem pricing is less effective. Thus, with increased competition from road carriers, the traditional tariff structure has had to be altered, and generally speaking, the wide dispersion of rates has narrowed.

The general reaction of the South African Railways is not to increase the competition even though the competition could lead to cut the rates in view of meeting the need. The Government, however, is in a difficult position due to its historical monopoly position, which did not require a detailed knowledge of operating costs. However, generally speaking, they have not made very much effort to ascertain what these costs are and so do not know whether the rates they charge are profitable or not. The South African Railways freely admit to not knowing what their services cost them, and as Bland discovered, "No studies had been made of the costs in relation to particular classes of goods under all circumstances. Indeed they were considered impracticable. Such ad hoc studies as had been made related to train load movements over specific routes, either of particular commodities or of all commodities handled on a particular train."[26]

Before discussing the other steps the railways have taken to retain and attract freight, it must be remembered that they are not entirely free to operate as a commercial

---

[25] R.R. Hirst, "The transport Industry," in A. Hunter (ed.), pp. 65-111.

[26] H.A. Bland, "Reflections on Land Transport in Victoria," Australian Transport, July-August, 1972, pp. 36-43.

enterprise. For example, they have a common carrier responsibility, which entails their acceptance of all freight that is offered, uneconomic lines to be kept open to further the government's strategy and other social policies. Moreover, rate changes have to be approved by the government, and the railways are used as an instrument of government policy without specific subsidization.

The traditional complicated cost and value classifications of commodities used in determining freight rates is done by the South African Railways Company. However, the basic principle is to allocate every conceivable commodity to a class for which a certain rate is charged. There can be discounts on these charges and there are also special schedules for certain commodities and automobile, for example, attracts special attention in all provinces.

To take Gauteng as an example,[27] some commodities such as Briquette, Firewood, Flour, Grain, Hay, Manure, Sand, and Unseasoned Hardwood Timber, per tonne rates are then quoted for distances between 1 and 1000 kilometres, are subject to assorted wagon-load minima. An example of one such schedule is shown in Table 3. However, there are concession rates for country industries, certain export consignments and a host of unrelated goods. The end usage of certain products seems to be generally relevant, such as "Formaldehyde Solution shall be charged Class 'B' rate and conditions."[28] (These products would normally be carried at the more expensive Class 'C' rate). There are also a few commodities that are carried free such as consignment to or from Railway Refreshment Rooms managed by the Department of Transport, and exhibits for Government Tourist Sectors.

However, it is not in the area of cuts to scheduled rates that the railways have done most to meet increased competition. The railways have to meet the competition, and in this regard special freight rates have to be quoted to rail users in the areas most susceptible to other forms of competitive transport.[29] The vast majority of freight could move by rail, particularly in areas where road transport can be competitive.

These movements are usually of large volumes of freight as their main purpose is to reduce operating costs, encourage industry and secure freight for the railways. An assortment of commodities could be the subject of negotiations. For example, in South Africa, where the railways have had to do most to retain traffic, special rates are quoted for volume users of transport for such goods as steel, coal, gypsum, salt, textile, overseas shipping containers and general merchandise, and a great increase in tonnages carried at these reduced rates has resulted in recent years. In some of the other provinces, the negotiated rates carry with them some obligations for the shipper. In South Africa, slightly reduced rates are offered for a wide range of goods if rail is used for all the company's transport requirements, although there are obvious problems in enforcing such an agreement. However, incentive rates are negotiated with individual companies for the carriage of groceries, aerated waters and hardware. In return, the company undertakes to be responsible for terminal handling. The Government also applies special rates on commodities, which have been instrumental in expanding and upgrading the rail system. The rates are negotiated on the basis of

---

[27] This information is taken from *White Paper on National Transport Policy*, September 1996, p 24.

[28] Personal Interview with Spoornet.

[29] N.S.W. Commissioner for Railways, Annual Report for the Year Ended 30th June 1957, p. 13.

projected incremental costs plus a margin and are influenced by the amount of capital injected by the Government for additional and improved railways facilities and rolling stock.

Table 3: South African Railways' Owner's Risk Rates per Bale for Baled Hay.

Kilometres	Wagon- loads	Minimum 120 bales	Kilometres	Wagon-Loads	Minimum 120 bales	Kilometres	Wagon-loads	Minimum120 bales
	Rand	Rand	Oaten and	Wheaten Rand	Hay Rand		Rand	Rand
1 – 16	3	3	112 - 124	11	12	467 – 531	20	25
17 – 37	4	4	125 - 145	12	14	532 – 563	21	26
38 – 40	5	5	146 - 167	13	16	564 – 643	22	27
41 – 48	5	6	168 - 199	14	17	644 – 724	23	28
49 – 58	6	7	200 - 264	15	18	725 – 772	24	29
59 – 72	7	8	265 - 296	16	20	773 – 853	25	30
73 – 77	8	9	297 - 322	17	21	854 – 901	26	32
78 – 98	9	10	323 - 402	18	22	902 – 966	27	33
99 – 111	10	11	403 - 466	19	23	967 - 1000	28	34
			Lucerne and	Grass or	Meadow Hay			
1 – 16	4	4	133 - 145	15	18	532 – 563	26	32
17 – 37	5	5	146 - 167	16	19	564 – 611	27	33
38 – 42	6	7	168 - 183	17	20	612 – 660	28	34
43 – 54	7	8	184 - 215	18	22	661 – 724	29	35
55 – 58	8	9	216 - 264	19	23	725 – 772	30	36
59 – 72	9	10	265 - 296	20	24	773 – 820	31	37
73 – 77	10	11	297 - 322	21	25	821 – 869	32	38
78 – 88	11	12	323 - 370	22	27	870 – 933	33	39
89 – 106	12	13	371 - 402	23	28	934 – 966	34	41
107 – 114	13	14	403 - 466	24	29	967 - 1000	35	42
115 – 132	14	16	467 - 531	25	30			

Source: Spoornet

*Subject to the undermentioned wagonload minima:

Capacity and/ or type of Wagon	Minimum Load per Wagon
Four wheeled wagon	240 bales
QR bogie wagon	480 bales
Other bogie wagon	640 bales

Consignments of less than 120 bales shall be charged:

Minimum 2 tonnes	Class "A – 10%"
Under 2 tonnes	Class "B – 10%" "Small" minimum

Freight charges on these lesser quantities shall be assessed on the basis of:

Oaten and Wheaten Hay	40 bales to the tonne
Lucerne and Grass or Meadow Hay	32 bales to the tonne.

Costs are much more apparent in the setting of these special rates, although some Provinces seem to have a sounder basis than other. The Commissioners of the Railways have stated, "The yardstick used is the average cost per wagon mile for operations within a region. The aim is to obtain, within the limits set by competition, a revenue return as much as possible in excess of average avoidable costs so that some contribution is made to unavoidable fixed costs."[30] Unfortunately, the average cost per wagon mile seems to be generally unknown except in the few isolated cases where the Railways have done cost surveys for specific large volume traffics.

On the other hand, although they may not have entirely solved the costing problem, the South African Railways seem to have a better understanding of the factors involved in rate setting.[31] For example, although "what the traffic will bear" is the major principle behind pricing, considerations such as rural/ industrial products, the class of wagon required, the disposal of that wagon, the prospect of back loading and possible government subsidies also enter the calculations. The difficulties of rate setting are appreciated, with bases of the pricing problem being:

a) The total amount of the charges must be based on a reasonable use of the facilities.
b) Two or more rates may be charged for the same service, each including an equal amount for the variable, but differing amounts for the fixed costs. The offering of a lower rate to some prospective users may promote a use of the facilities, which would not be possible otherwise.
c) The prospect of backloading. The "out-of-pocket" costs attributable to the return trip must be recovered in the rate, but any additional sum, which can be extracted from the consignor, is a financial gain.

[30] This information is taken from personal Interview with the Commissioners of the Railways.

[31] Information on the Railways' rate –setting policies was obtained by personal Interview.

There are marked differences between rates and traffic volumes in inter-region and intra-region movements. The former are characterized by heavy traffic loadings and low operating costs, where as there is tremendous variation of traffic within a province between branch lines and main lines.[32] To meet road competition, South Africa introduced uniform classifications, rates and conditions for intersystem goods traffic. (See Table 4 for example). However much inter-regions traffic moves under special rates, so it is again impossible to generalize about transport costs. However, the South African Railways Commissioners have pointed out "rail rates per ton mile for intersystem traffic are low, but because of the near ideal operating conditions- full train loads moving without interruption from origin to destination- and above all, because of the high annual tonnages involved, unit costs are also low and the traffic is profitable to the Department."[33]

It appears that in Railways intra-region operations, only a handful of routes approach the traffic density, which is achieved, on the two inter-region lines, and in terms of net tons carried per route mile, the average traffic density on non-inter-region Gauteng lines is less than one-fifth of the density of the inter-region lines.[34] Although costs are not known, the Railways estimate that " the average cost per ton mile on Gauteng lines is approximately double the inter-region figure."[35]

Table 4: Examples of Intercity Total Rates

	A per tonne	**B per tonne**	**C per tonne**
	Rand	Rand	Rand
Johannesburg – Cape Town	138.20	159.20	189.60
Johannesburg – Durban	157.80	187.20	229.60
Johannesburg – Cape Town via Bloemfontein	76.80	90.00	107.60
Durban – Cape Town	206.40	251.20	315.60
Bloemfontein – Cape Town	69.60	80.00	95.20
Pretoria – Port Elisabeth	94.80	112.80	138.80
Pretoria – Berlin (Uitenhage)	196.00	236.40	294.80
Berlin (Uitenhage) – East London	184.00	221.60	275.20
Johannesburg – Berlin (Uitenhage)	143.20	172.40	214.00

Source: South African Railways

[32] G.R. W ebb, "Rail Freight Operations in Victoria, "paper delivered to E520 Physical Distribution Course, Monash University, 5.6.1973,pp.6 and 9.

[33] Repositioning Transport as an Enabler of Economic Growth, Annual Report 2003/04.

[34] This information is taken from personal Interview with Spoornet

[35] Personal Interview with Spoornet

A final way in which the railways have sought to alleviate competition from road and to concentrate on that part of the transport task for which they are best studied, namely bulk line haul, is by increasingly hiring out their stock for fixed sum and providing a locomotive to haul the train, allowing the shippers to load the wagons up to maximum capacity. This particularly relevant in the freight forwarding operation and will be further discussed in that context, but many individual companies lease railway wagons and some examples of the rates charged are shown in table 5.

As an extension of this system, the railways own and lease out a number of containers have a special type of wagon (the "B" type bogie flat wagon) designed for the multiple loading of containers of variable lengths, and have rates for the carriage of privately owned containers. Again, the freight forwarders provide a large proportion of this business and the high volume users are able to negotiate special rates, but the general charges are based on prescribed minimum weight and any weight in excess of the specified minimum is calculated on a tonnage basis for the additional weight loaded in the same container up to the permissible net maximum. Some examples for privately owned containers are shown in Table 6.

The rates shown in both Tables 5 and 6 show the effects of back – loading. The Railways' situation is much the same as that for road[36]. There are other railway services such as private and departmental bulk loading and the movement of shipping containers, which have not been covered above. However, the same principle applies throughout the railways' rates.

Table 5: Examples of South African Railways' Van Hire Rates.

Type of Van and / or Wagon	**Minimum Mass**	**Minimum Charge**	**Loading in Excess of Minimum Per Tonne**	**Maximum Charge.**
	Tonnes	**Rand**	**Rand**	**Rand**
From Johannesburg to Cape Town				
"WGX" wagon	24	1272.00	39.82	2090.50
Other bogie van or wagon not exceeding 41 tonne capacity	14	910.50	39.82	1672.00
"TLV" van	14	910.50	39.82	1672.00*

***** Loading in excess of 41 tonnes up to marked carrying capacity shall be charged at R44.80 per tonne.

Type of Van and / or Wagon	**Minimum Mass**	**Minimum Charge**	**Loading in Excess of**	**Maximum Charge.**

[36] This information is taken from *White Paper on National Policy on Airports and Airspace Management*, Department of Transport, 25 November 1997, p. 22

			Minimum Per Tonne	
	Tonnes	**Rand**	**Rand**	**Rand**
From Johannesburg to Durban				
"WGX" wagon	24	1209.20	37.84	1990.00
Other bogie van or wagon not exceeding 41 tonne capacity.	14	865.20	37.84	1592.00
"TLV" van	14	865.20	37.84	1592.00*

Source: South African Railways.

***** Loading in excess of 41 tonnes up to marked carrying capacity shall be charged at R155.36 per tonne

Table 6: Examples of South African Railways' Container Rates.

From Johannesburg to Cape Town

Container Size	**Freight Charge (R)**	**Remarks**
8 ft	24.00 per ton 80.00 per ton 720.00 per container	Loading up to 3 tons Additional loading over 3 tons. Minimum charge
14 ft 5 ins	240.00 per ton 80.00 per ton 1080.00 per ton	Loading up to 5 tons. Additional loading over 5 tons Minimum charge
16 ft 8 ins	240.00 per ton 80.00 per ton 1320.00 per ton	Loading up to 6 tons Additional loading over 6 tons Minimum charge
20ft	240.00 per ton 80.00 per ton 1680.00 per container	Loading up to 7 ½ tons. Additional loading over 7 ½ tons Minimum charge.
37 ft	240.00 per ton 80.00 per ton 2880.00 per container	Loading up to 12 tons Additional loading up to 12 tons Minimum charge.

From Cape Town to Johannesburg

Container Size	**Freight Charge (R)**	**Remarks**
8 ft	120.00 per ton. 80.00 per ton. 240.00 per container 180 per container	Loading up to 2 ½ tons. Additional loading over 2 ½ tons. Minimum charge Empty return.*
14 ft 5 ins	120.00 per ton. 80.00 per ton. 360.00 per container. 300.00 per container.	Loading up to 4 tons. Additional loading over 4 tons. Minimum charge. Empty return.
16 ft 8 ins	120.00 per ton. 80.00 per ton. 480.00 per container 360.00 per container	Loading up to 5 tons. Additional loading over 5 tons. Minimum charge. Empty return.
20ft	120.00 per ton. 80.00 per ton.	Loading up to 6 tons. Additional loading over 6 tons.

	540.00 per container. 420 per container	Minimum charge. Empty return.
37 ft	120.00 per ton. 80.00 per ton. 960.00 per container. 960.00 per container.	Loading up to 12 tons. Additional loading over 12 tons. Minimum charge. Empty return.

Source: South African Railways.

***** Because of the nature of the traffic, empty return rates are not quoted from Johannesburg to Cape Town.

Note: These are the latest readily available rates. They have since been metricated but are included in imperial units as this was the accepted format in 1978.

Schedules are used for small or irregular consignments and these rates are based on what the traffic will bear, modified to meet competition, but if a user regularly moves large volumes, special rates can be negotiated and may be considerably be below published charges. The latter are of course confidential, so as with road transport, no general conclusions can be drawn.

4. FREIGHT FORWARDERS[37].

The freight forwarders are unique in the transport industry in that they use all the modes, although mainly road and rail, and are able to quote rates for any type of movement. They specialize in a door – to – door service and are used extensively by industry to avoid companies' time in arranging each of their individual transport needs. Because the forwarders' size and the volume of goods they carry, they are able to negotiate special rates within each line – haul media and are also to offer reduced prices to their large customers. They operate mostly in the inter-province field except in so much as local cartage is required for pick – ups and deliveries[38].

As with the other forms of transport, schedules of rates are not published officially. Road schedules are produced in the same way as local cartage rates, through discussion with the constituent bodies of the South African Transport Department; rail rates depend almost entirely on the line – haul agreements that the forwarders can make with the railways. Scheduled rates for road and rail are shown in Tables 7.

Special quotation rates are generally based on elaborate costing procedures. As in the organized side of the local cartage industry, the exact cost involved in any movement is known and the rate offered is a percentage mark – up on the cost. The aim is for a 20 per cent gross margin overall, but the individual amount charged can be affected by many factors, including the basic decision of how badly you want the business. This changes from time to time depending on the traffic between various cities. It may not be possible

[37] Except where otherwise stated, all information in this section has been obtained by personal interview.

[38] Rimmer, P.J., Freight Forwarding in Australia, Canberra, 1970, pp. 149 – 150

to move any more goods between Johannesburg and Durban, say, without diverting trucks from other routes, whereas the loadings to Piertersburg may perhaps be rather low.

Table 7: Rail Rates Johannesburg as of 1st July, 1998.

Weight	Cape Town	Durban	Eastlondon	Pieter-marisburg	Port Elisabeth	Piertersburg
Consignment fee. Then add per Kilogram to 45 Kg.	R 5.48 R1.69	R 5.48 R1.53	R 5.48 R1.42	R 5.48 R1.36	R 5.48 R1.44	R 5.35 R1.31
45 Kg or 1.82m^3 costs Then add per Kilogram to 454 Kg.	R36.92 R1.42	R29.48 R1.24	R24.68 R1.21	R24.24 R1.21	R27.44 R1.25	R22.32 R1.19
18, 144 Kg or 72.58m^3 costs Over 18, 144 Kg Flat rate per Kg	R3879.72 R1.21	R1979.28 R1.11	R1758.64 R1.09	R843.66 R1.08	R2053.64 R1.11	R1738.67 R1.07

Source: Combined Major Freight Forwarders.

Other relevant factors that have been identified are: 6 / 30 / 90 days payment, the nature of the commodity, the variety of items, the type of cartons, the value for insurance, the distance involved in pick – up and delivery, the ease of access to the customer's premises, the spread of deliveries, idle time, fragility, the possibility of backloading, special types of service (road, flexi – van or container) and the amount of handling[39].

4.1 ROAD OPERATIONS

The freight forwarding companies are characterized by generally not owning very many of their road vehicles. There are four basic operations and each affects the company's costing system differently.

Firstly, there are those vehicles, which do belong to the company. On these the costing is identical to that employed in the local cartage industry described above. There are fixed costs apportioned on a time basis and variable costs that accrue per mile traveled. These are reduced to a ton – mile base, which forms the break even level of work a vehicle, is doing. For example, off – highway movements, usually to the mining settlements, incurs greater depreciation charges and maintenance costs, so such considerations must be included when quoting rates.

All work beyond the scope of the company's own fleet is done by owner / driver subcontractors. There are however, three classifications within this category: Tow operators, Painted subcontractors and independent monoline subcontractors. The first groups own their own prime – movers and are paid to tow a trailer terminal to the terminal. The freight is already loaded and the driver merely hitches the trailer to his

[39] Rimmer, P.J., Freight Forwarding in Australia, Canberra, 1970, p 111.

prime – mover, drives to the destination, drops the load, picks up another and drives back. Theoretically, this only works out to be about two – and half, but even so, this represents a saving in capital equipment. For this work, the subcontractor is paid per mile[40], so that adding trailer costs per mile, the total cost of the journey can be calculated.

The painted and independent monoline subcontractors are paid at the same rate, but the painted operators, i.e. those whose equipment bears the name of the forwarding company, have priority in backloading. As noticed above, this is a very important consideration and it is usually operating through a truck broker, who cut rates to ridiculous levels in order to obtain a return load. The rates these operators are paid for one pick – up and one delivery are depending on the distance between one city to another. Certain percentage per tonne is added to the total load for each additional pick – up / delivery to cover the costs of the local action.

If a trailer picks – ups and drops are made, handling costs are negligible, as the consignor and the consignee do all the loading and unloading. Where full loads are being hauled, the mark-up on costs would be about the 20 per cent gross margin aimed for overall. However, this would increase to around 22,5 per cent if the trailers were not full, as maximum utilisation of the equipment is not possible. However, as soon as smaller consignments are being carried, costs rise astronomically and the mark – up may be as much as 33 per cent because of all the extra work that is involved. Another reason that higher charges can be made for smalls is that competition is less fierce than in the purely collection, line haul and delivery action. As soon as handling is required, depots have to be built and manned, equipment has to be purchased and an office has to be established for administration. There are not as companies geared to such an operation as there are in the more straight – forward side of transport.

For lots of less than 4 tonnes, feeder services are needed for local pick – ups and deliveries, to bring freight into the depot for consolidation and to distribute it after sorting. Local carriers will often be used for this work, although many of them operate as painted subcontractors. An example of a general freight rate scale is shown in Table 8 and rates for the cartage of containers, cargo trays, flexiflats and empty trailers are also specified by the forwarders.

The cost of this feeder service must be added onto the line haul cost, as must that of handling which may be as much as R12.50 per tonne. The latter cost includes dockhands' wages, industrial overheads, and forklifts, rental of terminal, supervision costs, and so on. There are also costs associated with the freight office, including clerks' wages, office rental, telephone bills, heating and lighting, which are allocated at about R3.6 per tonne.

It may seem from the foregoing that there should be little difficulty in obtaining the hoped for 20 per cent gross margin. However, this is not necessarily the case, as

[40] Figures quoted here were supplied by a major freight forwarding company, but cannot be assumed to be uniform throughout the industry

substantial discounts may be given to large companies shipping significant volumes. The problem here is that it is not always easy to obtain rate increases from these large customers. If the costs rise 5 per cent and prices are raised to compensate, perhaps only a 2 or 3 per cent increase will be possible from these clients, with a resulting decrease in profit.

Table 8: General Freight Scale

Weight	**Rate per Pick – Up or Delivery**
1bs	R (Rand)
Up to 25	1.56
26 – 100	3.04
101 – 500	4.20
501 – 1, 000	7.24
1, 001 – 1, 500	9.68
1, 501 – 2, 000	12.12
2, 001 – 3, 000	14.76
3, 001 – 4, 000	17.28
4, 001 – 5, 000	20.28
5, 001 – 6, 000	22.96
6, 001 – 7, 000	25.84
7, 001 – 8, 000	28.72

Source: Combined data from Major Freight Forwarders.

Thereafter add R5.67 for each additional 2, 000 1bs.

Mileage

Up to 5 miles ex depot - No mileage allowance
Over 5 miles - Consignment under 2, 000 1bs – 40c per consignment.
- Consignment over 2, 000 1bs – 40c per mile.

Note: The above rates are intended to apply only to freight of a hand-loaded nature or where lack of mechanical assistance forces hand loading of freight, which might otherwise be loaded mechanically.

Fortunately, this situation is improving at present, as the large companies want to deal with profitable organisations and so feel some obligation to keep the transport companies that way. This is a relief for some of the firms, a large percentage of whose revenue comes from two or three big customer.

Road rates will not only depend on he distance and weight carried but also on the type of service demanded. There are three sorts being offered:

1. Overnight Express – pick in Johannesburg on Monday and deliver to Cape Town or Durban before noon on Tuesday;

2. General Express – pick – up in Johannesburg on Monday and deliver to Cape Town or Durban on Tuesday afternoon.
3. General – pick – up in Johannesburg on Monday and deliver to Cape Town or Durban on Wednesday morning.

The cost involved in the three differs, as do the rates. For the overnight express service, a night shift has to be worked, so greatly increasing labour costs and inflating the rates. It is also impossible to do an overnight run to Cape Town in semi – trailer, so cut down rigid vehicles have to be used. These have the same sized engine as the larger trucks for a smaller capacity, thus also increasing per tonne line haul costs. This service therefore attracts rates up to three times those of general service. The general express is also more expensive than the normal schedule, with increased handling costs due to a larger labour requirement, but the rates would be only about one – and – a – half times those for general service.

4.2 RAIL OPERATIONS

The freight forwarders' rail operations are obviously closely linked with the services the South African Railways can offer and the prices they demand for them. All the forwarders hire rail wagons, many of them on an annual lease basis for which they receive a 20 per cent rebate on the casual rate. However, these wagons must run every day on a round trip basis, so the companies must ensure that they have sufficient freight to make the operation worthwhile. Examples of Forwarding Agents' Bulk Loading Rates for casual hire are shown in Table 9. The railways undertake only the line haul, all terminal costs such as loading, unloading and documentation being met by the forwarder.

The volume of forwarding agents' traffic has grown very rapidly and now accounts for about 30 per cent of total inter-region freight traffic[41]. For any large company, which has sufficient volume to run a full trainload each day, each way between Johannesburg and Cape Town, this would undoubtedly be the best business the railways could likely to have[42].

The line haul cost of rail is cheaper than that of road and to fully utilize the formers potential, the forwarders have been instrumental in developing new forms of equipment. Because of their ease of handling, containers are being used more and more extensively, but it is with transivans and flexivans that the forwarders have really streamlined their operations. These are basically the trailer part of a semi – trailer that can be quickly transferred to flat railway wagons by the use of special equipment and then just as easily rehitched to a prime – mover for delivery from the goods depot.

Table 9: Gauteng Railways' Forwarding Agents' Bulk Loading Rates as of 1st September 1998.

---

[41] Webb, G.R. "Rail Freight Operations in Victoria." Monash University, June 1973, p. 8.

[42] This information was taken from *Repositioning Transport as an Enabler of Economic Growth*, Annual Report 2003/04, p. 15.

Type of Van and / or Wagon	Minimum Mass	Minimum Charge per Van or Wagon	Loading in Excess of Minimum Per Tonne
Johannesburg to Cape Town	Tonnes	Rand	Rand
"WVX" van	32	1049.80	29.75
"OX" Wagon	25	854.40	29.75
"GOX" wagon	20	1278.20	20.02
Any other bogie van not exceeding 41 tonnes capacity including "LCX" or "LDX"	25	854.40	29.75

Source: Spoornet

All other vans: -

Minimum 10 tonnes per van	R 448.95 per van
Additional loading over 10 tonnes	R 21.56 per Tonne

Although the line – haul part of a road / rail / road movement is cheaper, the necessity of feeder services and handling increases the cost to that of road. From Tables 8 it can be seen that rail becomes cheaper for heavier loads, but is identical for light freight. This is because of rail's inherent advantages for bulk loading – high fixed costs and low variable costs give lower rates per tonne with high capacity utilisation.

As Thomas has said, "The key to the enormous success of this system [the forwarders' rail services] is the intense utilisation of equipment both for the railways and the forwarder[43]". When one considers that the volume carried on the trains is equivalent to for instance 133 semi – trailers doing one return trip between Johannesburg and Cape Town every week of the year, and that doubling the freight carried only gives two bigger trains rather than 266 semi – trailers, one must hope for an expansion of this operation with a corresponding decrease in road traffic. This is likely to occur as rail equipment improves giving a faster and better service than road.

The railways' main problem is to acquire sufficient rolling stock and to have it on hand when required. The railways are obliged to return empty wagons to their originating point, which results in a cost to the taxpayer, but unfortunately the system does not always work, so leaving one Government's Railways without any available wagons. Because of the independent road haulers cutting rates to obtain backloading, many transiflats return to Johannesburg empty – about 40 per cent of those from Cape Town and Durban – which is a cost that has to be written into forward rates. If some rationalisations were to occur, rail rates might become lower than those for road on all trips.

There is one area in which the freight forwarders' rail operation has extended to each province work. In South Africa, the Blue Train-Private owned is an example of

[43] H.A. Bland, Report of the Board of inquiry into the Victorian Land Transport System, p. 12.

concessional freighting which permits forwarding agents to consolidate small consignments to save the railways the costs of accounting and handling what now amounts to approximately one – third of the total "smalls" traffic conveyed by rail. In return the agent is given incentive rates and is able to provide a door – to door service for the customer.

5. CASE OF MOTOR FORD COMPANY IN SOUTH AFRICA

5.1. INTRODUCTION

In the majority of cases, rate is the most important single factor influencing companies' decisions on choice of transport mode. However, there are occasions when other considerations carry more weight, of these, incidence of damage is probably the most important, which road having considerable advantage over rail in the area. In the case of Ford Motor company in South Africa, the mode offering the lowest rates will not necessarily give the lowest total distribution cost because of differences in handling requirements, inventory levels and packaging. Although there are some problems in using total distribution cost, a detailed calculation can only be made with the aid of a computer. Large companies that are able to negotiate rates with the transport industry obtain a considerable advantage over their smaller competitors. Among some companies, Ford South Africa is able to dictate its own terms.

Because of this, companies are very secretive about the rates they pay for transport. Due to the size of the South African market, it is difficult to reap maximum plant economies of scale, so transport become an important area where costs can be pared by large organizations[44].

5.2. GOODS' MOVEMENTS

Since Ford is generally a larger user than its suppliers are manufacturers, it has a better bargaining base for transport. It therefore undertakes to arrange all transport of components from suppliers as well as moving nationally manufactured item and completed vehicle. Thus Ford's goods' movements fall into two categories: material movements from suppliers and manufacturing plant to the assembly plants and the shipment of built-up vehicles from the latter to customers. The approximate volumes of those movements are shown in Table 10. The small amount of material moved to Eastern Cape is to supply a reactivation plant which replaces any parts damaged whilst completed vehicles are in transit from the Eastern Cape.

5.3. METHOD OF TRANSPORT

Volume moving by each of road, rail and air are shown in Table 10. An accurate breakdown by mode of goods moving between two provinces is not possible because of fluctuations due to specific requirements.

---

[44] Personal interview with Ford South Africa Ltd

In general, about 70 rail trucks per day are moved between the manufacturing and assembly plants, but varying amounts are carried by road in Ford's own vehicles. The latter are also used within other metropolitan areas. In most cases, the company negotiates its rates with the South African Railways or carriers; its only commitment to freight forwarders at present is the moving of between five and eight containers a day between Eastern Cape and Gauteng. Air freight is occasionally used if components are required urgently.

5.4. CHOICE OF MODE

Ford's choice of mode is made on the basis of total distribution cost. For each mode, the company costs the whole physical distribution system from point of manufacture until the goods are loaded ready for line haul.

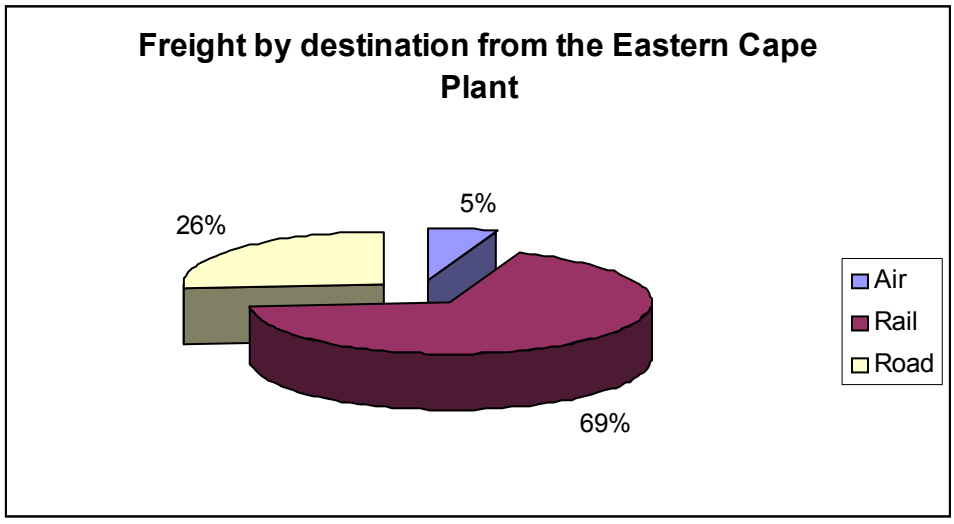
Table 10: Ford Motor Company- Full year 1998 of Built-up Vehicles

DESTINATION

Eastern Cape Plant	Gauteng	Other Provinces	TOTAL
Road	2, 512	43,448	45,960
Rail	6, 584	42,074	48,658
Air	526	6,391	6,917
Total	9, 622	91,913	101,535

Source: Motor Ford SA

Figure 1: Freight by destination from the Eastern Cape Plant to Gauteng and other provinces



Quotations are then obtained from railways and road operators and added to the above to obtain total distribution costs for each mode. The cheaper one is then selected. Thus the lower line haul rate is not necessarily the mode chosen. For example, rail is usually cheaper than road for line haul, but may require sufficient extra packaging or handling to erase this advantage.

The regularity of the service is also taken into account, as the more services there are, the smaller the stock that has to be held. With this in mind, Ford also calculates the optimum frequency of service and the quantities required in each order. Into these is also added a safety margin to cover fluctuations in demand and any other unexpected contingencies. Thus the total cost in required inventory becomes very significant in the choice of transport mode.

However, there are certain factors that may over-ride these calculations in decision-making. For example, one advantage of road is that goods may be sent at any size lots. Thus, even though the bulk of plants movements are by rail, considerable volumes also travel by road. Because of the economies of production runs, it is not always possible for the exact part needed to be ready when the train leaves, so road transport has to be used if delivery is urgent. Some seeming anomalies in vehicle shipments can be similarly explained. Although the majority of movements are by rail, road is extensively utilized for the reverse journey. The reason for this is that Ford employ road carriers to move completed vehicles from plants to all provinces of South Africa because they are cheaper than rail, but have to send them on into Gauteng to collect vehicles for back loading. In general, rail is the better mode where back loading is not available, as users do not have to pay for the return of empty wagons.

It is interesting to note that the vast majority of movements within a province are by road, despite the fact that from Ford's point of view door-to-door delivery of a vehicle with no intermediate handling has obvious advantages.

The choice of mode can be affected by the availability of suitable railway rolling stock. At present, old, open-top wagons are used, but Ford is hoping to persuade the railways to introduce new, enclosed, high-cube wagons, 75 feet long and able to stack three pallets high instead of the present two. Three savings would accrue from this: forklift trucks instead of the present two could do investment flexibility, loading and unloading by forklifts would be quicker; packaging costs would be reduced – there would be less risk of damage with enclosed wagons, particularly as rust caused by rail would be eliminated. Such wagons would initially be used between Eastern Cape and KwaZulu-Natal, but in future, all movements out of Eastern Cape could be rail instead of road and Ford would not have to employ freight forwarder for its Pietermarisburg deliveries. Although road is at present used more than rail, the introduction of such rolling stock could shift the balance considerably.
Regarding the transport costs, when the sums being spent on moving significant volumes are considerable, the company is able to negotiate contracts with the railways and road operators, which would be likely to offer very favorable rates.

5.5. ANALYSIS

Theoretically Ford approaches its transport arrangements in a highly scientific way and should be attaining optimal allocation of resources. However, there are several problems in this approach, of which the company is no doubt aware. The most significant of these is the measurement of costs required in the calculation of total distribution cost. It is difficult to understand the concept of a plant closure "costing R8, 000 to R12,000 per minute", and on a more basic level, exactly what does warehousing, for example, "cost" a company? Although it is probably highly impractical, factors such as alternative uses of funds should be considered. If rail is used, it is likely that larger inventories will be held. As discussed above, this would have been considered in the calculation of total distribution cots, so that by having a larger investment in stocks, savings could be made in distribution costs. However, if the capital so employed could be invested elsewhere at a return high enough to cancel out the transportation cost differential, then suing the more expensive mode of transport would give better allocation of total resources. Such calculations are not being proposed as feasible alternative to the present method because their obvious practical difficulties, but the theory does emphasize that complete reliance on a concept such as total distribution cost is not advisable. There may be circumstances where exogenous factors outweigh the result of theoretical calculations.

Ford is a good example of the power a large company wields in the transport industry. The company is almost able to dictate its own terms, even to the extent of suggesting new types of rolling stock to the railways. It would be one of the few companies that arranges transport from its suppliers, but considerable cost savings can obviously be realized. Such arrangements also allow Ford a greater degree of control over their component manufactures which is necessary in a fast-moving, production line operation which faces huge losses if work is interrupted because of stock shortages.

6. PRESENT SITUATION OF GAUTENG'S PROVINCE

As already discussed[45], the Department of Transport has aligned its activities to respond to the challenges in the freight sector in the year under review. Firstly, there are high structural logistics costs as a result of the South Africa geographic location, system level inefficiency, lack of integration across modes and limited competition, as well as a lack of capacity in the rail and port environments. Secondly, the sector is characterized by poor service predictability resulting from an excessive supply-side orientation, monopoly and oligopoly industry structure, operational inefficiency and lack of investment. This has a significant impact on the country's economy and its development. It is estimated that port congestion alone contributes to a 0.43% reduction in GDP[46].

Freight forwarders play a significant role in Gaunteg and South Africa's inter-cities trade. There has been a need for consolidation of consignments into approved size containers or

---

[45] Hirst, R.R., "The Transport Industry" in A. Hunter, ed., Melbourne University Press, 1963, p. 11.

[46] Repositioning Transport as an Enabler of Economic Growth, Annual Report 2003/04, p.18.

pallets or onto trailers. Most of the containers and equipment are owned by the freight forwarders and leased out to the shippers, although the shipping companies supply equipment to some large customers. The forwarder arranges for the container to be packed at the factory or at his terminal, so removing much of the cargo handling and associated facilities from the wharf. Shipping companies have been able to make considerable savings from these arrangements, but in many instances, the costs have been placed with the forwarder, so that rates to the consignor of the freight have not altered appreciably[47].

The ton mile charges for road covering the delivery to or pick up of goods in containers from the wharves also inflate rates within provinces. In this case, all consignments have to at least be coordinated through the forwarder's depot because of the necessity of collecting from delivery to the wharves, whereas some large consignment being transported on the mainland can be delivered straight to the consignee, so saving some terminal costs. The latter charges are of the order of R4.46 per ton for distances of less than 10 miles. Movements on the mainland, which involve direct loading onto trailers, which participate in the line haul, do not incur such charges[48].

7. SETTING OF THE MODEL

A CGE model is an economy-wide model that includes feedback between demand, income and production structure, and where all prices adjust until decisions made in production are consistent with decisions made in demand (Naudé & Brixen, 1993a). It considers the economy as a complete system of interdependent components (industries, investors, households, governments, importers and exporters). It explicitly recognizes that economic shocks impacting on any one component can have repercussions throughout the system and that accounting for these repercussions may be essential in assessing the shocks – even on the components upon which they impact initially (Naudé & Brixen, 1993b).

The ORANI-JL adapted from the ORANI-G model is a static computable general equilibrium model of the South African economy based closely on the Australian ORANI-G model[49]. It is a model of the economy in a single period, designed for comparative static analysis of the effect of the policy changes on the economy in that period. ORANI-JL disaggregates the economy into:

- 15 single commodity producing industries;
- 15 related industries;
- 2 household categories;
- 3 labour occupations; and
- 4 margin commodities

---

[47] Roots, W., "Road Transport in Western Australia," September-October, 1972, p. 3.

[48] "Road vs Rail Under Labour Government, "Truck and Bus Transportation, January, 1973, p. 17

[49] The model ORANI-JL was developed by Jean Luc Erero with the help of Dr Mark Horidge from the *Centre of Policy Studies* (CoPS) at the Monash University, Melbourne, Australia.

Due to the size of ORANI-JL, a complete description falls outside the scope of the present paper. However, for a more complete description[50], see Horidge (1997). Because of our focus on labour productivity issues, some comments on the modelling a labour productivity in the ORANI-JL may be appropriate.

The production function is explained in the documentation of Mark Horridge, "ORANI-G: A Generic Single-Country Computable General Equilibrium Model", Centre of Policy Studies and Impact Project, Monash University, Australia, 1997. We revisit the commodity composites (intermediate inputs), the primary-factor composite (primary inputs) and "other costs" are combined using a Leontief production function, given by:

$$X1TOT(i) = \frac{1}{A1TOT(i)} \times$$
$$MIN\left[All,c,COM: \frac{X1\_S(c,i)}{A1\_S(c,i)}, \frac{X1PRIM(i)}{A1PRIM(i)}, \frac{X1OCT(i)}{A1OCT(i)}\right]. \quad (1)$$

where
X1TOT (i) denotes an index of industry activity by sector(i)
X1OCT (i) denotes demand for "other costs" by sector(i)
A1TOT (i) denotes an all input augmenting technical change by sector(i)
A1_S (i) denotes an intermediate input augmenting technical change by sector(i)
A1PRIM (i) denotes an all primary input augmenting technical change by sector(i)
A1OCT (i) denotes an "other cost" input augmenting technical change by sector(i)

X1PRIM(i), as illustrated in the equation below, is dependant on the three primary factors:

$$X1PRIM(i) = CES\left[\frac{X1LAB\_O(i)}{A1LAB\_O(i)}, \frac{X1CAP(i)}{A1CAP(i)}, \frac{X1LND(i)}{A1LND(i)}\right]. \quad (2)$$

where
X1PRIM(i) denotes demand for primary factors by sector(i).
X1LAB_O(i) denotes demand for labour by sector(i) - aggregated over occupation.
X1CAP(i) denotes demand for capital by sector(i).
X1LND(i) denotes demand for land by sector(i).

[50] The main equations of this model are derived from the constrained optimisation of neo-classical production and utility functions. Producers choose inputs to minimise costs of a given output subject to non-increasing returns to scale industry functions. Consumers are assumed to choose their purchases to maximise utility functions subject to budget constraints. Productions factors are paid according to their marginal productivity. The government sector is included and imperfect competition has been introduced via price fixing, rationing and quantitative restrictions. At the equilibrium level these models solutions provide a set of prices that clear all commodity and factor markets and make all individual agents' optimisations feasible and mutually consistent. The behavioural equations of the model are augmented by sets of equations showing the flows of income in the economy and sets of equations defining an economic equilibrium in each market as where supply equals demand. These equilibria may be reached via adjustments in prices and/or quantities. The present model uses a 1998 Social Accounting Matrix prepared by the author as database.

Factor-saving technical changes are included explicitly as the coefficients A1LAB_O(i), A1CAP(i), and A1LND(i). Changes in the relative prices of the primary factors induce substitution in favour of relatively cheapening factors. The percentage change in the average effective cost is a cost-weighted Divisia index of individual prices and technical changes.

8. MODELLING A LABOUR PRODUCTIVITY INCREASE THAT WILL TRANSLATE INTO A 10% INPUT/OUTPUT OVERALL PRICE DECREASE

The main mechanism, through which the effect of the rail freight sector labour productivity increase is modelled in this example, is through the technical change coefficient A1LAB_O ("RailFreigh"). We change the technical coefficient and "calibrate" the shock to the point were we observe an approximate 10 percent decrease in the average input/output price level of the Rail Freight transport "RailFreigh" sector, represented by the variable P1LAB_O ("RailFreigh").

The final resulting simulation yields a price change in the average input/output price of -10.065 percent by increasing labour productivity by approximately 26 percent.

8.1. Shock

We shocked P1LAB_O by –10% which allows us to simulate the effects of a 10% overall input/output price level of the Rail Freight sector, and the economy-wide effects of such a gain as a result of increasing labour productivity[51].

8.2. Closure

We used a short-run closure, capital and land usage in each industry are fixed while labour is everywhere in elastic supply at fixed real wages. Constant real wages in the short-run closure determine employment.
On the national expenditure side, real consumption, real aggregate investment, and real government consumption are fixed. Also it allocates fixed national investment across industries following endogenously determined rates of return (ROR).
Foreign currency prices of imports are naturally exogenous and the exchange rate is fixed as numeraire. Population is also held constant. There are other exogenous variables in this closure such as changes in rate of production tax, technology, price and quantity shift variables.

9. RESULTS INTERPRETATION

The impact of this simulation on various macro-economic variables are listed in the table below.

---

[51] We shocked this model by applying p1lab_o (ENDOGACOEF)=uniform -10. The shock affects the Rail Freight sub-sector.

Table 11: Impact on selected macro-economic variables

Macro-economic variable	% Change
Real GDP	0.1717
Total Employment	-0.1365
Average Real Wage Rates	0.0000
Real Domestic Consumption	0.0000
Consumer Price Effect	-0.1535
Government Consumption	0.0000
Export Volumes (FOB)	0.5878
Export Price Index	-0.1171
Import Volumes (CIF)	-0.0792
Import Price Index	0.0000
Balance of Trade as % of GDP (Nominal)	0.0014
Real Exchange Rate	0.0000

If one assumed for the moment that these current results are plausible, then the price decrease in the rail freight sub-sector have a positive impact on GDP, mainly through benefits for the export oriented sectors, as illustrated by the overall increase in export volumes and the resulting slight positive balance of trade as % of GDP result.

Similar to the previous paper, one has to caution the reader regarding the assumptions of achieving the required productivity efficiencies within a 3-year window and being able to shed approximately 20 percent of the labour for the sector, as is evident in the tables to follow.

However, this serves again to illustrate that efficient transport systems are needed to support access to markets and economic growth.

10. STRUCTURAL SECTORAL RESULTS

For the purposes of this analysis the following variables on a 15-sector level of detail are listed.

Table 12: Sectoral average input/output impacts

Sector	Price Impact % change	Sector Output or Value Added/GDP % change	Employment Impact % change	Import Volume Impact % change	Export Volume Impact % change
AgriForFis	0.0550	0.0972	0.3439	0.2545	0.0703
MiniQuarr	-0.0210	0.4089	0.8453	0.1609	0.4412
Manufac	-0.0027	0.1896	0.3888	0.1403	0.3486
ElecGasWt	-0.4107	0.1735	0.5659	0.0000	-1.6463
Construct	-0.0910	0.0313	0.0512	-0.1727	0.8316
WholeRet	-0.0890	0.1464	0.2859	-0.0825	1.0042

FinancServ	-0.0516	0.0555	0.1496	0.0438	0.5377
CommServ	-0.1128	0.1162	0.1483	-0.1083	0.9178
GovAdmin	-0.2785	0.0000	0.0000	0.0000	0.0000
LandPass	0.0142	0.1462	0.3355	0.2299	0.2661
AirPass	0.0171	0.1072	0.2825	0.1832	0.2519
RailFreigh	-10.0650	4.4992	-20.7024	-11.6118	69.6940
RoadFreigh	-0.0407	0.2264	0.3845	0.1654	0.5381
Other	-0.1317	0.1767	0.2623	0.0181	0.9907
Telecom	0.0594	0.0795	0.2663	0.2416	0.0426

Given the above closures, a rise in labor productivity resulting in a 10 percent fall in prices level in the rail freight sub-sector causes a fall in prices of domestically produced goods, which in turn raises exports in most sub-sectors. The positive price impact observed in agriculture (0.06%) (see table 12) can be attributed to drought, requiring an increase in volume of imports. In the case of land and air passenger sub-sectors the positive price impact (0.01% and 0.02%) can be explained in terms of administrative price setting. The impact on imports is mixed. Construction, wholesale trade, commercial services and of course rail freight experience a decline in imports. The remaining sub-sectors show an increase in the demand for foreign produced goods. A rise in labor productivity makes it possible to raise production, needed to meet rising foreign demand of domestically produced goods with less number of workers, and indeed employment falls (21%) substantially in the rail freight sub-sector. However, in the remaining sectors where labor productivity gains are not considered, a rise in production is made possible by a rise in the employed labor force. The fall in household demand across both categories of income in most sub-sectors could be largely explained by falling import volumes in relevant sectors. However, in the case of the rail sector domestic demand is likely to play a significant role in stimulating demand, hence output. The impact of the simulation results in the freight sub-sector far outweighs that of the remaining sectors.

When considering macroeconomic variables, the results of the model simulation are consistent with theoretical considerations. A rise in labor productivity causes a reduction (0.14%) in demand for labor, and simultaneously makes it possible to increase output (0.17%). Falling domestic prices (0.15%) in a fixed exchange rate environment lead to a surge in domestically produced goods in foreign markets; hence export volumes (0.59%) given that the respective price declines (12%).

Table 13: Sectoral average input/output household impacts

Sector	**Household demand Impacts – Total % change**	**Household demand Impact % change Low Income**	**Household demand Impact % change Middle and high Income**
AgriForFis_I	-0.0307	-0.0324	-0.0296
MiniQuarr_I	-0.0099	-0.0109	-0.0081

Manufac_I	-0.0201	-0.0220	-0.0192
ElecGasWt_I	-0.1399	-0.1421	-0.1393
Construct_I	-0.0522	-0.0536	-0.0508
WholeRet_I	0.0202	0.0182	0.0211
FinancServ_I	-0.0062	-0.0086	-0.0057
CommServ_I	0.0170	0.0147	0.0175
GovAdmin_I	-0.0522	-0.0536	-0.0508
LandPass_I	-0.0204	-0.0225	-0.0196
AirPass_I	-0.0212	-0.0232	-0.0203
RailFreigh_I	2.6022	2.6002	2.6032
RoadFreigh_I	-0.0063	-0.0082	-0.0053
Other_I	0.0139	0.0119	0.0148
Telecom_I	-0.0329	-0.0349	-0.0321

11. CONCLUSION

This attempt at modelling the efficiency gains as manifested through a reduction in the Rail Freight sector's average input/output prices and obtained through increased labour productivity in the sector, should be viewed as a cursory investigation only. In order to be in a position to evaluate this question in a more thorough fashion would require more research regarding the specific sensitivities and elasticities of the other economic sectors to that specifically of the Rail freight sub-sector.

However, the choice of rail as the main mode is historical. Some companies have built themselves up around the use of the railways, and once the commitment is the extent of rail terminal warehouses, it is difficult to change. However, one company says that it is cheaper to operate by rail than by road, and as there is not the need for fast, overnight delivery, rail is the best mode for them. The nature of their product also means that they do not suffer from the extensive breakage of which other companies complain.

Rates for rail line-haul tend to be lower than those for road haulage. However, double handling is required for most rail movements, so the total cost is increased, often to an amount greater than comparable road rates.

The only ways that rail can be profitably utilized seem to be by carrying full container loads that can be quickly loaded and unloaded onto rolling stock, or by having rail-terminal warehouses so that unloading is straight into stock. Because rail offers such large economies if the labour content of handling can be reduced, it seems likely that the future trend between provinces movements will be towards containerized rail transport.

As has been stressed throughout this paper, it is difficult to draw any valid conclusions on rates, simply because we not only do not know what the vast majority of them are, but also they may vary between customers over the same route.

Rimmer studied the rates charged by freight forwarders in considerable depth[52], but was unable to find any recognizable pattern. The only way in which the principle of "rates generally increasing at a decreasing rate[53]" could be applied was to group destinations into major cities, Johannesburg and Cape Town and Durban and to consider other minor cities as an isolated case.

In the majority of cases, rates are the most important single factor influencing companies' decisions on choice of transport mode. However, there are occasions when other considerations carry more weight, of these, incidence of damage is probably the most important, which road having considerable advantage over rail in the area. Furthermore, the mode offering the lowest rates will not necessarily give the lowest total distribution cost because of differences in handling requirements, inventory levels and packaging. Rates for rail-haul tend to be lower than those for road haulage.

However, there seems to be very little real value in trying to generalize even on the published rates because of their lack of correspondence with reality. It will cost more per tonne mile to send goods from Johannesburg to Cape Town than it will to the other cities, but what the actual charge is depends on who you are, what mode you use, who undertakes the transport task, what service you require, how much you send and how. The foregoing merely gives a broad idea of maximum rates, the types of service offered and the factors considered in rate setting.

As far as the future is concerned, it seems unlikely that there will be any major changes in the rate structure of road transport; alterations will merely follow cost changes. It is to be hoped that increasing numbers of small operators will make some effort to determine their costs and base their rates on these, so reducing the high level of bankruptcy prevalent in the industry at this time.

Valid, generalized, objective conclusions on how road transport should be regulated seem elusive at present. Every developed country in the world is battling with the problem and although isolated solutions may have been found, there is no one "right" answer. However, the road transport industry's view has been rather well expressed by Roots (1972) through this statement "Never in the history of human conflict have so many bewildering regulations been suffered by so few for so long."[54]

However, the next few years could see some changes in the railways' rate setting mechanism. It must be recommended that charges should be related to cost of services rendered and should be uniform and non-discriminatory with regard to user or commodity. Rimmer pointed out that "a major hazard in charging, "what the traffic will bear" is that the user may not "bear" a price in the long run, that he is prepared to accept in the short run. When he is able to find an alternative, his custom will be lost, and it

---

[52] Batt, N. "Transport Aid is Urgent." The Australian, Survey of Tasmania, 7th August, 1973, p. 13.

[53] Yates, G.H. "States Hold Key to the Industry." The Australian, 17th July, 1973, p.312.

[54] W. Roots, "Road Transport in Western Australia," September-October, 1972, pp. 32-35.

could happen that even goods suited to rail, such as large quantities of superphosphate, cement, pulpwood, iron and steel, would move by road at a higher social cost[55].

It seems likely that freight forwarders will be of increasing importance in transport operations. Their move into the distribution field has relieved several companies of problems in this area, so there is no reason that the trend should not continue, particularly for companies that require inter-province warehousing facilities.

South African Railways would do well to heed this advice and revolutionize their approach to rate setting.

REFERENCES

Armington PS (1969) The Geographic Pattern of Trade and the Effects of Price Changes, *IMF Staff Papers*, XVI, July, pp 176-199.

Armington PS (1970) Adjustment of Trade Balances: Some Experiments with a Model of Trade Among Many Countries, *IMF Staff Papers*, XVII, November, pp 488-523.

Australian Road Transport Federation. Commercial Motor Vehicle Operators' Guide to Taxes, Fees_and Regulatory Legislation in Australia, Sydney, 1971.

Bland, H.A., "Ref1ections on Land Transport in Victoria," Australian Transport, July-August, 1972,pp. 36-43

Bland, H .A. Report of the Board of Inquiry into the Victorian Land Transport System, Government Printer, Melbourne, 1971-72.

Blunden, W..R.; R.H. Buchanan and D. Oedjoe, "Costs of Distribution" in R.H. Buchanan and C.G. Sinc1air eds, *Costs and Economic of Australian Process Industries*, pp. 1301-1316, West Pub.) Sydney, 1964.

Cameron, M, De Jongh, D, Joubert, R, Suleman, A, Horridge, JM & Parmenter, BR, 1994: IDC-GEM simulations for the workshop on economy-wide models of the South African economy, Development Bank of Southern Africa, 14-16 July 1994, Halfway House.

Cameron, C., de Jongh, D., Joubert, R., Suleman, A., Horridge, J.M. & Parmenter, B.R. (1994): *IDC-GEM simulations for the workshop on economy-wide models of the South African economy*, Development Bank of Southern Africa, 14-16 July 1994, Halfway House.

Carvalho, Soniya (2003). *2002 Annual Review of Development Effectiveness - Achieving Development Outcomes: The Millennium Challenge*. The World Bank. Washington. ISBN 0-8213-5436-1

Chowdhury, A & Kirkpatrick, C.(1994), 'Development Policy and Planning: An Introduction to Models and Techniques', London and New York:Routledge

Cooper R, McLaren K and Powell A (1985) Macroeconomic Closure in Applied General Equilibrium Modelling: Experience from ORANI and Agenda for Further Research, in J. Piggot and J. Whalley (eds), *New Developments in Applied General Equilib*

[55] Thomas, K.W. "Projected Transport in the '70's" , Melbourne, September, 1970, p. 165.

rium Analysis, New York: Cambridge University Press.
Davidson, J.A. "Transport Barriers Facing a Nationally Operating Industrial Service Company, "Australian Transportation Conference Report, Canberra, 1971, pp. 26 – 34.
Dixon PB, Parmenter BR, Powell AA and Wilcoxen PJ (1992) *Notes and Problems in Applied General Equilibrium Economics*, Amsterdam: North-Holland.
Dixon PB, Parmenter BR, Sutton JM and Vincent DP (1982) *ORANI: A Multisectoral Model of the Australian Economy*, Amsterdam:North-Holland,*hereafter DPSV*.
Dixon PB, Bowles S and Kendrick D (1980) *Notes and Problems in Microeconomic Theory*, Amsterdam: North-Holland.
Dixon PB, Powell A and Parmenter BR (1979) *Structural Adaptation in an Ailing Macroeconomy*, Melbourne University Press.
Gollege, R.G., "Methods in Australian Trade and Transportation Studies" in G.H. Drury and M.I. Logan. eds. *Studies in Australian _Geography*, pp. 303-327, Heinemann EdlJ.cationa1 Australia Pty Ltd, Ne1bourne, 1968.
Gye, C.F., Some New Thoughts on Reshaping Transport, "Australian Transport, May - June) 1972, pp. 19 and 21.
Hertel TW, Horridge JM and Pearson KR (1992) Mending the Family Tree, *Economic Modelling*, October, pp 385-407
Hirst, R.R., "The Transport Industry!! in A, Hunter, ed., .*The Economics of Australian Industries* pp. 65-111, Melbourne University Press, 1963.
Horridge J.M., Parmenter B.R. & Pearson K.R. (1993): ORANI-G: A General Equilibrium Model of the Australian Economy, Generic version, Revised March 1997.
Johansen L (1960) *A Multisectoral Model of Economic Growth*, Amsterdam:North-Holland, (2nd edition 1974).
Joy, S., "Unregulated Road Haulage: the - Australian Experience," Oxford Economic Papers, Vol. 16 (]uly 1964;), No. 2, pp. 275-285,
Ko1sen, H.M., "*The Economics and Control of Road-Rail Competition*, Sydney University Press, 1968.
Lundberg, D. E., Krishnamoorthy, M., & Stavenga, M. H. (1995). *Tourism economic*s. New York: John Wiley & Sons.
Marks, L.E. "Economics of Road Transport." A.N.Z.A.A.S. 44th Congress, Section 5, Engineering, Sydney, August, 1972.
Open Road' Policy Welcomed, but Troubles are Foreseen, "Truck and Bus Transportation, March, 1973, pp. 122 and 126.
Owen, N.J,. "What's the Official Thinking on Truck and Bus Dimensions?" Truck and Bus Transportation, August, 1971, pp. 82, 83 and 109.
Powell A (1977) The IMPACT Project: an Overview—First Progress Report of the IMPACT Project, Vol 1,Canberra:Australian Government Publishing Service.
Powell A (1991) A Brief Account of Activities 1988 to 1990, *IMPACT Project Report* No. R-08, February, 50pp.
Rimmer, P.J., *Freight Forwarding in Australia*, Research School of Pacific Studies, Departm3nt of Human Geography Publication HG/4, A.N.U., Canberra, 1970.
Taplin, J.H.E. "Economic Problems of Transport Development. " A.N.Z.A.A.S. 44th Congress, Section 5, Engineering. Sydney, August, 1972.
Thomas, K.W. "Projected Transport in the '70's" Proceedings of the 15th Australian Canning Convention, Melbourne, September, 1970, pp. 159-174.

"The. Australian Transport Scene," Australian Transport Journal of the Chartered Institute of Transport. In Australia, September-October, 1972 and l1 March-April,1973.

Sen, Huseynin (1996). Unpublished Assessed Article, Bradford University, Development Project Planning Centre (DPPC), Bradford, UK.

Yates, G.H. "States Hold Key to the Industry." The Australian, 17th July, 1973.

Van der Mensbrugghe, D. (1995): *Technical description of the World Bank CGE of the South African economy*, Unpublished report OECD, Paris.

Van der Merwe, C. & van Seventer, D.E.N. (1995*): Towards a system of economic and social accounting matrices for South Africa*, Development Paper 63, Development Bank of Southern Africa, Halfway House.

Webb, G.R. "Rail Freight Operations in Victoria." E520, Physical Distribution Course, Monash University, June, 1973.

http://www.monash.edu.au/policy/working.htm