

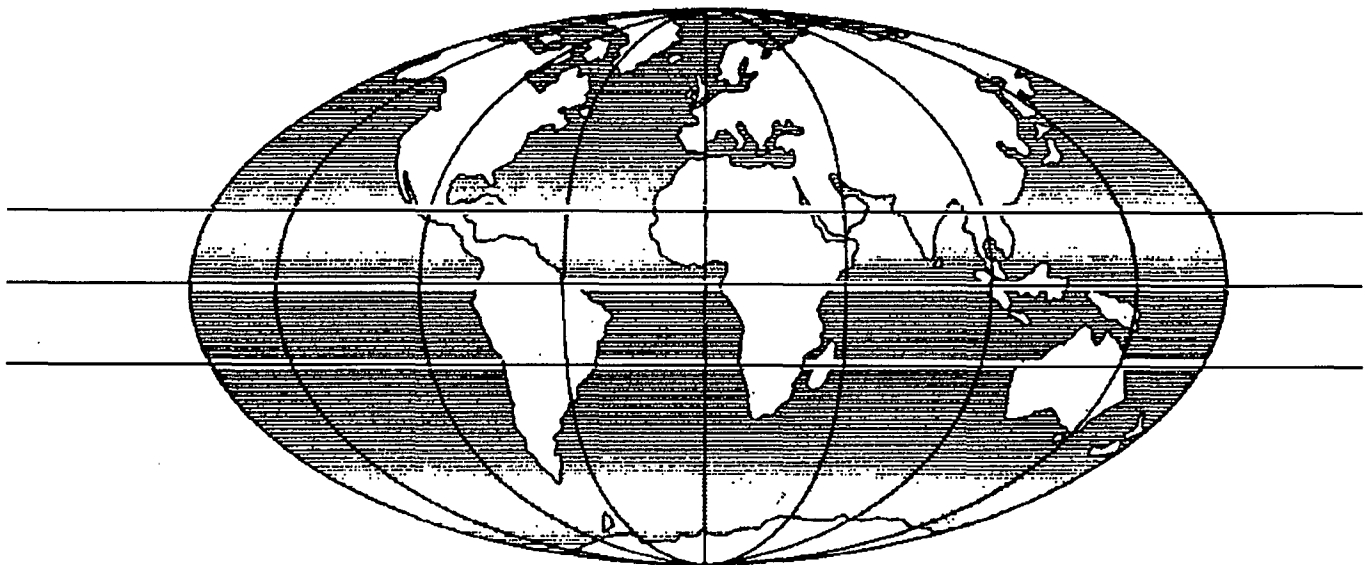


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RIZET, C and JL Hine, 1993. A comparison of the costs and productivity of road freight transport in Africa and Pakistan. *Transport Reviews*, 13 (2), 151-165.

## **A comparison of the costs and productivity of road freight transport in Africa and Pakistan**

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Freight tariffs in a number of African countries have been found to be between four and six times the levels found in Pakistan. This paper examines how the differences in input costs, taxation, profitability and vehicle productivity contribute to the differences in tariffs. Some suggestions are made to indicate how these differences may have arisen.

### **1. Introduction**

Road freight tariffs in Africa are very high compared to the level of tariffs found elsewhere. This issue was highlighted at the Seminar 'The Economics and Politics of Trucking in Sub-Saharan Africa' held in Yamoussoukro, Côte D'Ivoire, 1989. A comparison of the data presented in different papers at the Seminar indicated that long distance freight tariffs in a number of African countries were in the region of four to six times the level of those prevailing in Pakistan (LET, ENSTP and INRETS, 1989).

This paper analyses the main factors behind these differences in tariffs. The African data was derived from research carried out in francophone Africa by the Institut National de Recherche sur les Transports et leur Sécurité (INRETS) and the Laboratoire d'Economie des Transports (LET) in collaboration with local university teams. The Pakistan data was derived from a study carried out by the Overseas Unit of the Transport and Road Research Laboratory (TRRL) in cooperation with the National Transport Research Centre (NTRC) in Islamabad.

Variations in vehicle productivity and input prices are the main factors which determine the differences in the average level of freight tariffs and costs between different countries. The prices of vehicles, spare parts and fuel vary greatly between countries and part of this variation is due to differences in taxation. Likewise variations in vehicle productivity may be accounted for by differences in the distances driven, load factors and the rates of consumption of fuel, tyres and spare parts. In order to quantify how each of these effects contributes to the differences in freight costs between Africa and Pakistan a series of indices was defined and then derived from comparisons of cost and productivity data (Rizet 1990).

### **2. The data used: surveys in Africa and Pakistan**

Although the two studies were carried out independently they had numerous points in common. Both collected a wide range of data from detailed surveys of transport

† From April 1992, renamed the 'Transport Research Laboratory'.

operators which enabled a comparative analysis of freight tariffs and operating costs to be undertaken.

### 2.1. *In Africa*

The study carried out by INRETS and LET, in collaboration with African University teams, dealt with three countries: Cameroun, Côte D'Ivoire and Mali (LET and INRETS 1989). They belong to the CFA Franc zone, which gives them a certain degree of homogeneity. For long distance trips, road freight tariffs and costs were comparable, with differences of about 10% between the most expensive country (Cameroun) and the two others. The data used in the analysis (an average of the three countries) may be considered to be representative of the CFA Franc zone. In addition there is some evidence to suggest that for a number of other (non-CFA) countries freight tariffs and costs were also comparable.

The field surveys made in 1988 were of two types.

- (a) Tariff data were derived from surveys of freight hauliers and consignors. The observation unit was the consignment, and the sample used (1500 interviews) allowed relatively detailed statistical analysis.
- (b) The costs of hauliers were derived from 150 structured interviews. From the survey it was possible to identify the operation of the different categories of hauliers and to reconstruct the operating expenses for certain types of vehicles.

### 2.2. *In Pakistan*

Five different surveys were undertaken in 1986 by the Overseas Unit, TRRL in cooperation with the National Transport Research Centre in Islamabad (Hine 1988, Hine and Chilver 1991 a).

The main component was a roadside survey in which 3500 truck drivers were interviewed at 39 sites around the country. As drivers were in charge of finding work, collecting the payments due, keeping accounts and maintaining the vehicle, they were able to answer a wide range of questions on vehicle operations. The information collected during this survey contained data on trips, loads, tariffs and fleet operation. Complementary information on the vehicles concerning their ages, makes, types, values, owners, financing, operating performance, costs and insurances was also collected.

In another survey, structured interviews were held with 188 companies involved in freight consigning and with 237 freight forwarding agents. Information was collected on the choice of transport mode, the use of freight forwarding agents and the reasons behind the relatively limited use made of 'own account' transport in Pakistan. The freight forwarding agents were asked a wide variety of questions on how their business was undertaken, what other ancillary services (such as warehousing, vehicle finance and direct provision of transport) were provided and the time taken to find transport.

The trip records of over 50 drivers were gathered on the revenues and costs of the vehicles relating to a number of previous years. Another survey obtained precise information on vehicle use and a survey of past tariff data was organized to determine past trends and the seasonal pattern of freight tariffs. A survey of road surface roughness was also undertaken.

### 2.3. *The main problems raised by the comparison*

The comparison of data collected at different times in radically different countries raises a number of questions. Two of the more important issues are discussed.

### 2.3.1. *Survey dates, exchange rates, and inflation*

The Pakistan cost and tariff data relates to 1986 whereas the African data relates to 1988. These data are presented in CFA Francs and the 1986 exchange rate of 21 F CFA to 1 Pakistan Rupee (Pak Rs) is used. In the period mid-1986 to mid-1988 the price levels in Pakistan, Côte D'Ivoire and Cameroun all rose by about 15%; however, in the same period the Pakistani Rupee fell in value by 24% so that in 1988 its average value was about 16 F CFA.

One way of reconciling the difference in survey dates is to adjust Pakistani tariffs to 1988 levels and apply the 1988 exchange rate. Previous research has shown that in Pakistan changes in average level of freight tariffs had closely followed the rate of price inflation. However, as can be seen above, during the period in question inflation in Pakistan was less than the decline in the value of Rupee measured in CFA Francs. Hence if an allowance had been made for inflation in Pakistan and if the 1988 exchange rate had been used then an even greater difference in tariffs between Pakistan and Africa would have been apparent.

### 2.3.2. *Vehicle fleets*

The structure of the vehicle fleets and the use of different types of vehicles differ considerably between Africa and Pakistan. These factors have a very important influence on the production costs of transport. In this paper two types of vehicle operations are analysed:

- (a) long-distance transport using tractor and semi-trailer; in this case the Pakistani vehicles have a design capacity of 13 tonnes (t) while their African counterparts have a design capacity of 25 t;
- (b) the operations of an identical vehicle (a Japanese three-axle truck with 12 t payload); in this case the African vehicles tend to be used for shorter 'regional journeys' rather than the long distance transport that these vehicles make in Pakistan.

## 3. **Transport tariffs**

In each country studied, the survey data provided information on the main characteristics of each consignment; i.e. the origin and destination (giving the trip distance), the nature and weight of the goods, and the types of vehicles and infrastructure used. The influence of these consignment characteristics on the levels of transport tariffs was comparable for Africa and Pakistan.

Unit prices, measured in CFA Francs per tonne-kilometre (tkm), vary greatly within each country, but these variations can be explained to a large extent by the distance and weight characteristics of the consignments. In general the unit prices for transport decreases when either the distance or the tonnage increases. These two characteristics, distance and tonnage, are strongly correlated: consignment size tends to be high for long distance trips while for short trips average consignment size tends to be much lower.

Figure 1 shows, for different countries, how the average unit tariff (per tkm) varies with the magnitude of the consignment, expressed in tkm per trip. The data relate to a range of vehicle types and journey distances. For small consignments, of 50 to 100 tkm, tariffs were very similar in Africa and Pakistan: about 150 to 200 F CFA per tkm.

In Africa, tariffs per tkm declined considerably and regularly as the magnitude of the consignment increased, decreasing to about 20 F CFA per tkm for consignments of

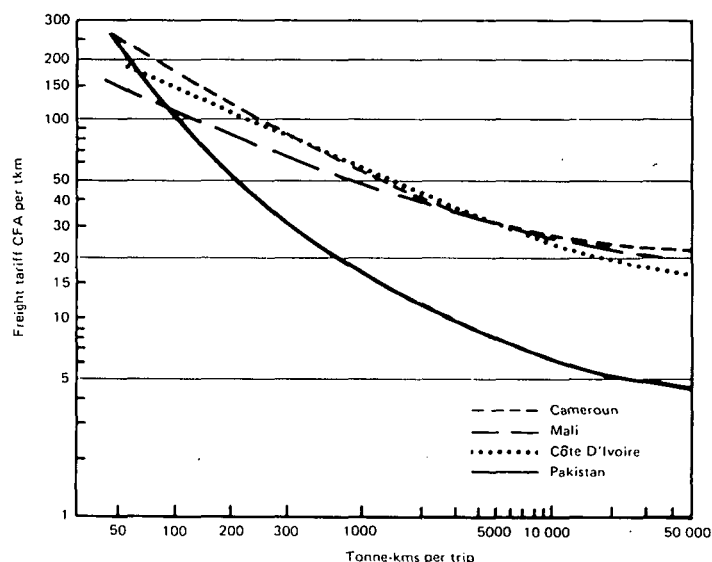


Figure 1. Transport tariffs for Pakistan and three African countries related to the magnitude of consignments (expressed in tonne-kilometres with logarithmic scales).

more than 40 000 tkm. These long distance tariffs were found to be comparable with the rates for international traffic (initially expressed in US \$) between Zambia, Zimbabwe and neighbouring countries which, in 1989, were in the region of 24–40 F CFA (8–14 US ¢) per tkm.

In comparison with Africa, unit tariffs decreased much faster in Pakistan as the magnitude of the consignment increased; for the largest and longest distance consignments they fell below 5 F CFA per tkm. For these consignments tariffs in Africa were over four times higher than in Pakistan. Similar low rates to those found in Pakistan have also been found for long distance traffic in other Asian countries including India and Vietnam. The influence of characteristics other than distance and weight on tariffs were less important.

The lack of balance in directional traffic flows is reflected in tariff levels. In Pakistan as in Africa, an important part of the goods to be carried result from international trade which passes through the major ports (such as Douala, Abidjan, or Karachi). These ports receive more imported goods to be carried inland than goods from the interior to be exported. Transport tariffs reflect these imbalances and are in general much higher for transport inland than for transport in the opposite direction.

Finally, transport on gravel roads or tracks is, in general, more expensive than transport on tarmacadam or bituminous road surfaces. Unit costs on poor road or track can be as much as 80% higher than on a paved road (Hine and Chilver 1991 b). Although there are differences in the average quality of road surfaces between Pakistan and the African countries it is not felt to be a major contributory factor to the differences in transport costs and tariffs.

#### 4. Long-distance transport costs

In each of the countries studied, the information collected from hauliers allowed for a reconstruction of the operating expenses for some vehicle types. For the African

Table 1. Mean consignment characteristics for a semi-trailer.

	Africa	Pakistan
Mean distance (km)	547	957
Mean load (tonnes)	31.7	25.7
Mean tariff (F CFA/load)	412 700	130 350
Mean tariff (F CFA/tkm)	23.8	5.3

Table 2. Comparative input cost data.

	Africa (1988) (average of 3 countries)		Pakistan (1986)	
	With taxes	Without taxes	With taxes	Without taxes
New tractor and semi-trailer (1000 F CFA)	44033	35140	13125	10938
Tyre (1000 F CFA)	216	121	74	56
Diesel fuel (F CFA/1)	212	144	89	80
Annual cost (1000 F CFA):				
Total wages and expenses	1393	1393	1356	1356
Vehicle insurance	499	408	2.7	2.6
Goods insurance	293	239	0	0
Licences and taxes	388	—	48	—

(Exchange rates: 1986, US \$1 = 350 F CFA = 16.6 Pak Rs; 1988, US \$1 = 285 F CFA = 18.1 Pak Rs).

example, an average estimate is presented which is based on the three countries investigated; cost and tariff differences were small between the three countries.

A tractor unit with semi-trailer is, in general, the most common vehicle configuration used for long-distance transport; this vehicle type is analysed here. In Africa, it is common for these vehicles to have a 25 t design payload; however, taking into account the normal overloading, the average consignment was estimated to be 32 t. Average annual distance travelled for these vehicles was 50 000 km per year. In Pakistan, the most common tractor and semi-trailer combinations had a design payload of only 13 t, but in general vehicles were reinforced in order to be capable of carrying much heavier loads. Some of the tractor units were trucks which have been converted with the addition of a 'fifth wheel'. Chassis were frequently reinforced and wheels, tyres, springs and axles were replaced by more durable components. The average load was 26 t, and the average annual distance travelled was 123 000 km. Consignment data are shown in table 1.

#### 4.1. Input costs

It can be seen from the data shown in table 2 that there were important differences in input costs (also referred to as 'factor prices') for tractors and semi-trailers. Vehicles

and tyres were over three times the price in Africa compared with Pakistan, while fuel was over twice as expensive. Although there were large differences in crew costs amongst the African countries their average was very similar to that of Pakistan. Insurances and taxes were much higher in Africa than in Pakistan.

There are a number of reasons for the differences in input costs between Africa and Pakistan. Most vehicles are relatively simple and cheap and most tractor-units have engines of less than 200 hp with gearboxes that have only five forward gears. The vehicles are reinforced locally at low cost in order to take heavier loads; this they are able to do by running slowly (the average spot running speed is estimated to be 54 kph) over the relatively flat terrain. A wide range of low cost spare parts is manufactured locally. By comparison, in Africa most tractor-units and their spare parts are extremely expensive; they are often imported in small numbers and high mark-ups are usually applied by the distributors. Finally, in Pakistan, other production factors, such as fuel and tyres, are also very cheap.

#### 4.2. Total costs per vehicle kilometre

Table 3 compares total costs per km (broken down into components) of the tractors and semi-trailer combinations used in Africa and Pakistan. Because of the uncertainty associated with estimating the costs of some of the components the data should be treated with some caution. The calculations were made according to the same method for Africa and Pakistan. Although financial arrangements and interest costs were different in each country, for the sake of simplicity annual interest costs have been estimated to be 4% of the cost of a new vehicle. In the analysis the component costs have been identified as either fixed or dependent on distance travelled. So interest, insurance and crew have been defined as 'fixed' and depreciation, fuel and maintenance as 'distance dependent'. It should be recognized that this analysis is simplified and that different views may be taken on this allocation.

It can be seen from table 3 that, per km travelled, each of the cost headings is much higher for Africa than for Pakistan. In the table, total costs per tkm are shown to be 4.8

Table 3. Component costs for a tractor and semi-trailer (F FCA per km).

	Africa	Pakistan
Interest	35.2	4.3
Insurance	15.8	0.1
Crew	27.9	11.0
Licence and other taxes	7.8	0.4
Other fixed charges	42.1	2.9
Fixed costs	128.8	18.7
Depreciation	66.1	8.9
Fuel	112.4	43.7
Maintenance	90.8	17.2
Tyres	48.1	6.0
Road expenses	17.3	7.9
Distance dependent costs	334.7	83.7
Total costs	463.5	102.4
Total costs per tonne-kilometre carried	21.7	4.5



times higher in Africa than in Pakistan; their levels are just below the tariff rates shown in table 1.

Hence it appears that profit margins of African hauliers do not explain the tariff differences; in fact as a ratio of tariffs, the profits of African hauliers even seem to be less than those of their Pakistani colleagues. In part, this may be confirmed by the low rate of renewal of the fleet in Africa.

To explain tariff differences it is necessary to look at the differences in the underlying transport production cost. It is proposed to distinguish the cost differences which depend upon:

- (a) the unit prices of production factors such as vehicles, fuel, tyres or manpower;
- (b) those differences which are a function of the productivity of these components; that is to say the quantities consumed (e.g. of fuel, or tyres) or the distance travelled for producing one tkm from the fixed factors of production.

#### 4.3. *The relative influence of factor prices and productivity*

To estimate the influence of factor prices and vehicle productivity transport costs in Pakistan are calculated assuming African component costs while keeping Pakistan's productivity characteristics (fuel consumption, yearly distance travelled etc.). This is shown in table 4.

The table shows that the cost ratio per tkm between Africa and Pakistan would be reduced from 4.8 to only 1.7 if the component costs were the same in Pakistan as in Africa: this ratio is linked just to the productivity differences between the two countries; this will be called the 'productivity effect'.

By comparing column B and C in table 4 it can be seen that on average, component costs are reported to be 2.9 times higher in Africa than in Pakistan; this will be called the 'price effect'.

The differences in productivity and component costs are now examined in more detail. The separate effects contributing to the differences in prices and productivity are presented in ratio terms. When these are correctly multiplied together the overall cost differences are obtained (see figs 2 and 3 presented later). The ratios are given in two decimal places, this is not an indication of accuracy but to help show how the different ratios relate to each other.

#### 4.4. *The effects of taxation and factor prices*

It has been shown above that the level of taxes born by vehicle operators are higher in Africa than in Pakistan. In order to estimate the influence of taxes on the 'price effect',

Table 4. Comparison of transport cost by semi-trailer showing the effect of differences in productivity and price level in F CFA.

	A: Africa productivity African prices	B: Pakistani productivity African prices	C: Pakistani productivity Pakistani prices
Costs per kilometre	463.5	294.0	102.4
Cost per tonne-kilometre	21.7	12.9	4.5

the overall tax rates in Africa and Pakistan were calculated. The ratio of the effective rate of tax on the operations of tractor and semi-trailer vehicles in Africa to Pakistan was 1.12 and the 'price effect' exclusive of tax was 2.55. The latter ratio includes the effect of differences in input prices of vehicles, fuel, maintenance and labour. It also includes any price differences associated with the timing of the comparison, inflation and the chosen exchange rate. The other indicators discussed in the analysis are independent of these particular difficulties.

#### 4.5. *Factor productivity*

The effect of productivity on total costs can be subdivided into the following categories:

- (a) vehicle productivity per km travelled (this may be measured in terms of the average load weight carried per total distance travelled);
- (b) the total consumption of all components per km travelled; this may be further divided into:
  - (i) consumption of fixed components per km travelled (here productivity is dependent purely on differences in annual travel);
  - (ii) consumption of components which vary directly with distance travelled (such as fuel and tyres).

##### 4.5.1. *Vehicle productivity per km travelled*

This was greater in Pakistan, because the empty trip rate was much lower (i.e. 12% compared with 34%). The low level of empty running found in Pakistan is probably because of the longer average trip distances, the relatively low degree of vehicle specialization and the almost total absence of 'own account' vehicle operations. In contrast the relatively high degree of empty running in Africa may be linked to the lack of balance in the flows of foreign trade and to the narrow partitioning of the different transport market segments. Although it can be difficult to find return loads to the ports in both Pakistan and Africa, nevertheless the problem may well be more acute in Africa where the traffic is often very seasonal.

In Africa the average load carried by a tractor and semi-trailer, per km under load, was 32 t compared with 26 t in Pakistan; this was probably because of the higher design payload of the African vehicles. However, this did not compensate for the higher level of empty return trips of the African vehicles which, it is estimated, produced on average 8% less tkm per km travelled. In this way differences in vehicle productivity per km travelled increased overall costs for Africa compared with Pakistan by the ratio: 1.06.

##### 4.5.2. *The effect of total distance travelled on fixed costs*

In Africa, the efficiency in the use of vehicles is much lower than in Pakistan. For tractors and semi-trailers annual distance travelled was estimated to be 50 000 km in Africa compared with 123 000 km for Pakistan. As a result, in Africa, the fixed costs are spread over the fewer kilometres travelled.

There are a range of different factors which probably contribute to these differences in annual travel. There are important differences in working practices, competitive structure, the structure of demand and in the overall economic climate. In Pakistan, most heavy vehicles have two drivers who drive almost as much by night as by day. In

Table 5. Growth rates of GNP per person (per cent, per year).

	1973-1986 (%)	1986-1988 (%)
Cameroun	+6.1	-7.8
Côte D'Ivoire	-0.5	-9.4
Mali	+0.4	-2.5
Pakistan	+3.1	+3.4

Source: World Bank Atlas.

contrast, in Africa single drivers are more common and in some parts of Africa night driving is either forbidden or strongly discouraged. Other institutional factors can also cause delays, such as waiting at police and customs control posts or waiting to load or unload. These factors, although important, appear to cause less delays in Pakistan. For example in Pakistan, loading and unloading at night are relatively common.

In Africa competition is often restricted by collusion amongst transporters; this is mainly achieved by agreements to queue for loads (i.e. a transporter does not offer his vehicle for hire until other vehicles that have arrived before have been given business). In this way productivity is reduced and tariffs can be raised; this happens particularly with the movement of agricultural produce, which forms the main part of return freight to the ports. In comparison, in Pakistan freight transport is very competitive; there are no agreements to queue for loads and competition is further maintained by the very widespread use of freight forwarding agents who actively compete with each other for business.

Pakistan has a large mature industrial sector with many domestic inter-industry linkages (for example there are large scale movements of coal and iron and steel) and, as a result, there is possibly greater seasonal stability in the demand for transport compared with Africa, which appears to be more dependent on the movement of seasonal agricultural products. The over-capacity in the transport fleet in Africa has, in part, arisen because of the economic crisis that occurred during the eighties (and particularly since 1985). Table 5 shows that while economic growth was maintained in Pakistan, the African countries experienced a sharp decline in economic activity.

It may be felt that running speeds and journey distance may also explain some of the differences in annual travel; however both of these factors may be largely discounted. The evidence suggests that Pakistani trucks travel *more slowly* than those in Africa. Although it is true that trip distances were on average longer in Pakistan (947 km) than in Africa (547 km) there is little to indicate that this contributed to differences in annual travel. For example, in Pakistan it was found that average distance travelled per day was at a maximum for trip distances between 400 and 700 km.

Overall, differences in annual distance travelled on the consumption of the fixed cost components of running tractors and semi-trailers had the effect of making African costs 1.31 times higher than Pakistani costs.

#### 4.5.3. *The consumption of variable factors of production*

Differences in the rate of consumption of components such as fuel and tyres, which vary directly with distance travelled, had an important effect on the total cost

differences between Africa and Pakistan. Overall it was calculated that for tractors and semi-trailers these differences had the effect of making African costs 1.21 times higher than corresponding costs for Pakistan.

It is probable that both technical and behavioural factors explain these differences. On technical grounds, road surface quality can affect operating costs but, in this case, it is difficult to identify road surface quality as a major explanatory variable. (The effect of differences in road surface roughness on freight tariffs in Pakistan are examined in Hine and Chilver 1991 b). Nearly all of the main roads in Pakistan are paved with poor-to-average quality surfaces. The quality of road surfaces in the three African countries are variable. Ivory Coast has a good network of paved roads, most of the main roads in Cameroun are also paved, although there are important sections which are unpaved. In contrast, most of the roads in Mali are unpaved.

Fuel consumption is sensitive to gradients and so differences in terrain may explain part of the differences in fuel consumption between Pakistan and the African countries. Although parts of Pakistan are very mountainous, most of the main traffic flows are on flat straight roads. In contrast, there is more rolling terrain in the African countries. A more important reason for the differences in fuel consumption probably relates to engine power. Most vehicles in Pakistan are under-powered for the loads they carry and as result vehicles drive very slowly; in contrast, in Africa vehicles are more powerful and this may encourage drivers to drive fast and thus consume more fuel.

In general the behavioural differences between Africa and Pakistan can be identified by differences in the way that vehicles are looked after and maintained. Pakistani drivers take extreme care to look after the running performance of their vehicles. In Pakistan drivers are given complete responsibility by their employers for the overall running, maintenance and profitability for their vehicles. Besides driving very slowly they will also change the engine oil very frequently (in general more frequently than the manufacturers specify). The vehicles are maintained very cheaply through the large network of small informal workshops that are found all over the country. Each workshop will tend to specialize in providing a certain service. In contrast, in most of Africa drivers are not responsible for the maintenance of their vehicles; the maintenance is generally carried out at the owner's depot.

Figure 2 summarizes all of the different effects that the authors have been able to identify and quantify to explain the overall ratio in costs per ton km between Africa and Pakistan.

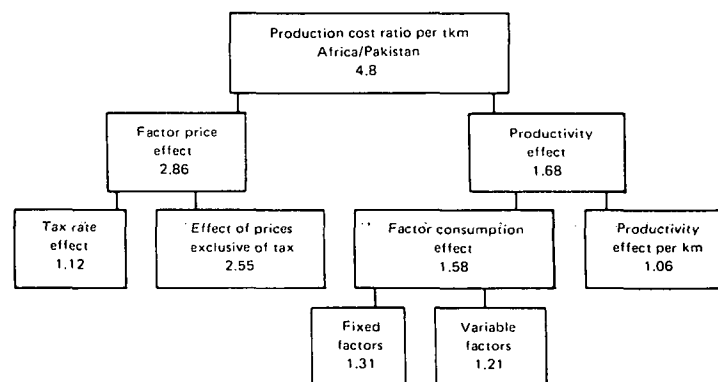


Figure 2. The influence of the different multiplier effects on the cost ratio, per tkm, between Africa and Pakistan, of running a tractor and semi-trailer on long distance routes.

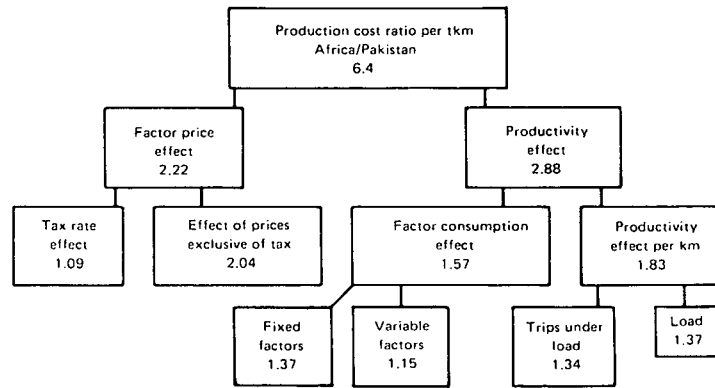


Figure 3. The influence of the different multiplier effects on the cost ratio, per tkm, between Africa and Pakistan, of running a three-axle Japanese rigid truck.

The figure shows that each one of the identified effects is unfavourable to Africa. It is the product of these 'small effects' that gives the final ratio of 4.8, in costs per tkm, between Africa and Pakistan for the transport provided by a tractor and semi-trailer.

The fact that different vehicle types were chosen in order to analyse the cost ratio between Africa and Pakistan has an unquestionable influence on the relative importance of the different elementary effects. The Pakistani tractor unit is less powerful, carries a lighter load and is cheaper than its African counterpart. As a result, assuming everything else remains the same, this can be expected to increase the price effect (exclusive of tax), and to reduce the effect of vehicle productivity per km travelled. The problem is now analysed using an identical type of vehicle.

### 5. Comparison of costs based on an identical vehicle type

For this comparison a rigid three-axle Japanese truck, which is designed to carry a 12 t payload, has been chosen; this vehicle type is widely used in both Africa and Pakistan.

In Africa this type of vehicle is often used for regional transport, that is to say for trip distances (and loads) that are less than those of the semi-trailers discussed earlier. For this truck, the average load was estimated at 14.6 t, and the annual distance travelled at 35 000 km. The tariffs and costs per tkm for this type of vehicle are clearly higher than those of the tractors and semi-trailers.

In Pakistan, on the contrary, these trucks are utilized almost in the same way as the semi-trailers analysed before, and their costs, per tkm, are also very similar. They are also reinforced on acquisition so that they can take much heavier loads than the one foreseen by the manufacturer. The average load of these trucks was estimated at 20 t, and the annual distance travelled at 136 000 km.

Figure 3 shows, for these vehicles, how the cost ratio between Africa and Pakistan is constructed.

The figure shows that for the three-axle truck costs are 6.4 times higher in Africa than in Pakistan compared with 4.8 times higher in Africa for long-distance freight transport using tractor and semi-trailers. The considerable differences between the two comparisons result from:

- (a) the effect of prices (exclusive tax)—this effect is less for the three-axle trucks than for tractors and semi-trailers, for tractors and semi-trailers the price effect

is 'overestimated' by the price differences between the different types of tractor units used in Pakistan and Africa; and

- (b) the productivity effect per km—this effect is much greater than in the previous comparison (i.e. 1.83 compared with 1.06 for the semi-trailers). This is a combined effect of the empty running (trips under load) and of the loads carried. In this example the load ratio is 1.37 (i.e. the ratio of 20 t for Pakistan to 14.6 t for Africa). In the previous example the productivity effect was low because the Pakistani semi-trailers had lower payloads than the African vehicles.

The fact that these vehicles do not provide the same type of transport in Pakistan and Africa contributes to explaining the higher cost ratio compared with the previous example. Vehicle productivity is, of course, directly related to the size of the load and the annual distance travelled.

### 6. Conclusion

The paper has shown that transport costs, per tkm, in three Francophone African countries (Cameroun, Côte D'Ivoire and Mali) were, in the period 1986–88, between four to six times higher than in Pakistan. There is some data to indicate that these results are not untypical of either Africa or Asia.

Despite any reservations there may be concerning survey dates and exchange rates, the analysis shows that Africa is at a disadvantage in every aspect: in Africa input costs are much higher and vehicle productivity much lower than in Pakistan. The resulting differences of transport prices and costs necessarily have important consequences for the trade and development of Africa.

The detailed comparison shows that there is a range of ways in which the African countries may achieve substantial gains through improved vehicle productivity and reductions in rates of consumption of inputs such as fuel and spare parts. Likewise it may also be possible to reduce factor prices through bulk ordering, and by encouraging competition from alternative (foreign and domestic) sources. Further measures to reduce costs in Africa are presented elsewhere (see Hine and Rizet 1991).

Another aspect that may be important in the comparison of production costs is the high level of overloading practised in Pakistan. It may be that the low vehicle running costs experienced by hauliers are partly compensated by higher expenditure on road construction and maintenance.

The method developed in this analysis provides a framework to quantify the influence of the different factors which intervene directly into the calculation of the comparative costs of transport. In this way it is limited to quantifiable 'technical' effects, which must then be interpreted in the context of the different environments in which the hauliers operate.

A factor which may limit the degree to which efficiency may be improved, and costs reduced, is the low level of competition in the freight markets of the different African countries. This is undoubtedly associated with the size and organization of the markets in these countries.

Pakistan (100 million inhabitants) has a population of about 10 times that of each of the African countries studied (Cameroun: 10 m, the Ivory Coast: 10 m, Mali: 8 m). With a large market and a high density of demand it is easier to sustain a high level of vehicle utilization. Moreover, in Africa the market of each country is fragmented: transport on 'own account' is more important and there is more specialization amongst hauliers that concentrate on particular products, or routes. (In comparison in France the freight

transport market is also strongly partitioned and, despite much higher labour costs and better quality of service, tariffs are intermediate between those of Africa and Pakistan for long-distance freight transport).

In Pakistan commercial freight transport operates on a free market basis with very little government regulation and entry into the industry has been very easy. Regulation in Africa has been somewhat greater but it is difficult to identify the effect of this on freight transport operations. Entry into the industry has also been relatively easy and, before 1985, was actively encouraged to help transport food aid to the countries of the Sahel.

In Africa, the mandatory road freight transport tariff regulations are rarely observed but, despite this, they provide a reference and so give a degree of protection for hauliers against severe tariff cutting. Pakistan has no official road freight transport tariffs.

Finally, the low level of competition in Africa is connected with the way transport is organized. Most business affairs are conducted between friends or relations, and the freight transport market does not escape this influence, particularly with regard to its most profitable operations. Prices can be kept at an artificially high level by the collusion amongst forwarding agents and transporters to ration out the available business through queuing. By contrast, in Pakistan the market is very competitive; the freight forwarding agent will entrust goods to the first haulier that accepts the tariff on offer. Here queuing for loads is prevented by the agent; if he sees a surplus of trucks waiting for business he will respond promptly by lowering tariffs. The agents are themselves in competition, for even in medium-size towns, there may be 15 to 20 agents competing for the same business.

The cultural and economic environment in Pakistan demands that the Pakistani operator conducts his business in a manner that is close to the economic model of perfect competition, while in the smaller markets in Africa, the relationships of community of interest or friendship remain a fundamental value. This weakness of competition in Africa results in a low activity level for many vehicles giving high fixed costs and a high empty-return trip rate. In a more competitive economy, these vehicles with low productivity would cease operating.

#### **Acknowledgments**

The study forms part of a programme of joint research between the Overseas Unit (Head: J. S. Yerrell) TRRL, UK and INRETS, France (Chargé de Mission pour les pays en développement: Mr X. Godard). The authors also wish to thank members of the NTRC (Pakistan), and the university groups in Africa who cooperated with LET (Laboratoire d'Economie des Transports, France) and INRETS, in the network of research teams called 'SITRASS' (Séminaire International sur les Transports en Afrique Sub-Saharienne). The paper is published by permission of the Chief Executive, Transport and Road Research Laboratory.

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#### **Foreign summaries**

En Afrique, les prix du transport routier de marchandises à longue distance sont entre quatre et six fois plus élevés qu'au Pakistan. Cet article analyse dans quelle mesure cet écart de prix du

transport peut s'expliquer par les différences constatées sur les prix des facteurs de production, sur les taxes, et sur les marges bénéficiaires des transporteurs ou par des différences de productivité du transport. Les auteurs proposent quelques explications de ces différences constatées.

Die Frachttarife in einer Reihe afrikanischer Statten sind vier- bis sechsmal so hoch wie in Pakistan. Dieser Artikel untersucht, welchen Anteil die Unterschiede in Einstandskosten, Besteuerung, Rentabilität und Produktivität der Fahrzeuge an den Tarifunterschieden haben. Es werden Vermutungen geäußert, wie diese Unterschiede zustande gekommen sind.

Se ha encontrado que las tarifas de carga en varios países africanos son entre cuatro y seis veces más altas que las existentes en Pakistán. Este trabajo examina cómo contribuyen las diferencias en los costos de insumos, impuestos, rentabilidad y productividad de los vehículos, a las diferencias tarifarias. Finalmente, se ofrecen sugerencias acerca de como se pueden haber producido estas diferencias.

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### Editorial suggestions for further reading

- HINE, J. L., and CHILVER, A. S., 1991, Pakistan road freight industry: an overview. Transport and Road Research Laboratory Research Report 314.

This report describes the main operational characteristics of the private road freight industry of Pakistan. It is based chiefly on the results of a nation-wide survey carried out in 1986, in which 3500 truck drivers were interviewed at 39 sites located at inter-district boundaries. Information was collected on vehicle age, make, body type, value, ownership, fleet management, finance, tariffs, load, operating performance, costs, and accidents. Additional information is presented from surveys of freight consignors and freight agents and from drivers' own records of operating costs and revenues. Until the early 1980s the industry was totally dominated by Bedford trucks with a design capacity of 7 tons. This truck is now declining in importance as more profitable, larger capacity trucks are introduced. Overall the industry is very competitive and the vehicle fleet is run efficiently. However there appears to be considerable scope for the introduction of greater numbers of larger vehicles.

(Authors)



HINE, J. L., and CHILVER, A. S., 1991, Use of freight tariffs to predict road investment benefits: some lessons from Pakistan, *Transportation Research Record*, **1291** (1), pp. 53–59.

There are several standard models of vehicle operating costs (VOCs) that are advocated for the appraisal of rural road investment in developing countries. The World Bank's Highway Design and Maintenance Standards Model (HDM) and the Transport and Road Research Laboratory's Road Transport Investment Model (RTIM) incorporate different models of VOCs based on research carried out in Kenya, the Caribbean, Brazil, and India. In the HDM, the user can select the most appropriate VOC model to suit local conditions. Because the different models give different estimates of benefits, a convenient way of selecting the most appropriate model form and of calibrating the results is needed. The role of competitively determined freight tariffs to assist with this task was investigated using data from rough and smooth roads in Pakistan. Although there are particular problems with using freight rates such as seasonality, empty running, and traffic directional flow imbalance, the results show that freight rates could prove to be useful in checking models of VOCs. Vehicle maintenance costs in Pakistan are particularly low, and therefore all of the standard models overestimated the difference in operating costs (per vehicle-kilometer) between rough and smooth roads. However, vehicle load weights were found to be lower on rough roads than on smooth roads. If loads increased with road improvement, important additional benefits would result that could be easily overlooked.

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