A Note on Petrol Versus Diesel Transport An Assessment of a Policy Option

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The policy of higher tax on petrol than on diesel gasoline encourages diesel transport. This may cause distortion and suboptimal allocation. This note is aimed at testing this hypothesis empirically. The First section briefly describes the petrol versus diesel argument. In the Second section cost comparisons are made for two petrol and diesel vehicles of comparable performance. The conclusion and policy options are discussed in the Third section.

PETROL VERSUS DIESEL: A THEORETICAL ANALYSIS

Diesel technology is a later invention, and is superior to petrol technology in several respects. Relatively, a diesel engine has a longer life, consumes less fuel and causes less pollution than a petrol engine. However, it costs more than a petrol engine of comparable performance. On the other hand, the cost of diesel gasoline, as visualized by producers and pricing agencies, is less than petrol gasoline. Therefore, a higher initial cost of the engine would be justified to the extent that savings in operating costs make up the difference.

Petrol and diesel are in joint supply virtually. The two are part of a production mix of crude oil. The proportion of various components depends upon the chemical qualities of crude. Variation in this proportion can be made but at highly increasing costs. In such cases of joint supply, the cost of production of individual components is theoretically indeterminate. Nevertheless, the assumption of lower cost of diesel can be accepted for practical purposes on considerations of less processing involved in the extraction of diesel than petrol.

Petrol has been a favourite commodity with the treasury for taxation for several reasons. Its users are mostly car owning persons who, as a class, fall in higher income groups. The car is a status symbol and a luxury good in

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poorer countries. Whereas the use of the car is being restricted in the rich countries on environmental grounds—congestion and demand for relatively more road space—its use in poorer countries which depend upon imports is not encouraged due to the scarcity of foreign exchange resources. High tax rates on petrol and cars, and import restrictions on cars are a consequence of this thinking. On the other hand, diesel is less favoured for additional taxation on public utility considerations. It is used in transport by public service vehicles which are used by less well off sections of the society. It is also used by industry and agriculture where there are alternative sources of energy as well. Thus the demand for diesel would not be as inelastic as that of petrol. In view of this, the tax on petrol and its price have always been higher than those of diesel. The higher tax on petrol provides an incentive for the use of diesel transport over and above its technical advantages.

The advantages of diesel technology increase with the size of the engine. Petrol engines have been virtually replaced by diesel engines in industry and heavy transport vehicles even in countries where the price differential is not much. In fact, the manufacture of petrol engines in the large size category has virtually ceased.

In the case of small vehicles, the diesel technology has not made any worthwhile impact so far. With the exception of a few makes, all cars and small commercial vehicles have petrol engines. The main barrier has been technological rather than economic or commercial.

In the category of middle size vehicles, comprising of station wagons, pickups, Jeepsters, and light commercial vehicles, both petrol and diesel engines are commonly found. This category of vehicles seems to be in the range where petrol and diesel engines are at even technological level. The relative prices of the two types of fuel would affect the choice of one or the other. In this category, higher tax on petrol would encourage the use of diesel transport even if petrol vehicles would be cheaper otherwise. To test this hypothesis, relative costs of two vehicles of similar characteristics are compared in the next section.

RELATIVE COSTS OF PETROL AND DIESEL TRANSPORT

Vehicle Characteristics

For purposes of comparison, it is essential that the two vehicles are of similar characteristics. Accordingly, we have taken Ford Station Wagons of same size and design, one having a petrol engine and the other a diesel engine. Their operating characteristics as indicated by the manufacturer are as below:

1.	Seating capacity	13 persons
2.	Fuel consumption	20-25 miles per gallon
3.	Life	200,000 miles

A few comments on the above figures are in order. The fuel consumption of both diesel and petrol station wagon is the same. This would seem to contradict the earlier statement that diesel engines consume less fuel than petrol engines. But it should be recalled that the advantages of a diesel engine increase with size, and that for medium size engines, petrol and diesel are at an

even technological level. Hence, similar fuel consumption by the petrol and diesel vehicles selected for investigation is to be expected. For purposes of cost calculation, average fuel consumption has been taken at 22.5 miles per gallon.

Regarding lifetime mileage, it may be mentioned that by good maintenance and timely replacement of wornout parts, any machine can be run for a long period of time. However, in the case of motor vehicles, major overhauling is required, on the average, after 200,000 miles. This involves substantial costs which vary widely depending upon the condition of the vehicle and quality specifications for the overhauling job. The cost of such repair and maintenance cannot, therefore, be precisely estimated. Besides, major overhauls often impair the reliability of vehicles which are then put on less demanding operations. The utilization of vehicles in their second life after major overhauls is not stable. Based on these considerations, 200,000 miles have been taken as the useful economic life of transport vehicles.

The time span over which lifetime mileage will be performed is also important in determining costs. The vehicles which are used extensively will perform their life time mileage in a shorter period, and their time-based costs such as interest on capital, wages and salaries of crew, taxes etc., would be lower on a per mile basis than similar costs of vehicles sparingly used over longer time period. Secondly, costs in the distant future will have less weight in net present value terms. Therefore, for estimating costs we need an estimate of the life of vehicles on a time scale as well. Generally, vehicles operating daily on intercity routes of 150 to 200 miles i.e., a one-way trip between Lahore and Rawalpindi or a round-trip between Rawalpindi and Peshawar, will do 200,000 miles in 3 to 4 years time. Vehicles operating in urban areas doing 100 miles a day will do the same mileage in 6 to 7 years. Still, private vehicles operating on working days only (e.g. vehicles owned by commercial organizations) and doing 50 to 60 miles a day will do 200,000 miles in 10 to 12 years. The proportion of vehicles in various types of operations is however not known. Therefore, for the sake of simplicity, it is assumed that the lifetime mileage is attained over a period of 5 years.

In reality, vehicles would remain on the road beyond 5 years or 200,000 miles after major repairs. But as indicated before, such repair costs cannot be precisely estimated and the mileage performed after major repairs would also be unreliable. Therefore, all operations beyond 200,000 miles and five years time have been ignored. This would not significantly affect the analysis as costs beyond 5 years and or 200,000 miles discounted to their net present value are slight.

Costs and Prices

The price composition for a Ford Station Wagon and its fuel consumption is given in Tables 1 and 2. These prices relate to the early 1975 period and are likely to have changed since then. In fact, the prices of fuel and vehicles have been subject to frequent changes over the last few years. In the case of fuel, there was a world-wide increase due to the increase in oil export prices by the oil producing countries. This was accompanied by adjustments in the taxes and duties on both fuel and vehicles in importing

countries. However, price variations have been upward and relative prices have not changed much. Hence the argument of this paper would be valid in the context of changed prices as well.

Table 1

Price Composition of a Ford Station Wagon in 1975

(Rupees)

		Petrol	Diesel
1.	CIF Value	22,055	35,285
2.	Taxes and Duties	11,745	18,778
3.	Assembling and Local Materials	7,027	7,827
4.	Other Expenses including Markup	8,661	12,294
5.	Retail Price	49,488	75,184
	Economic Cost (1+3)	(29,082)	(43,112)

Source: Awami Autos.

Table 2

Price Composition of Fuel in 1975

(Price in Rupees per gallon)

		Petrol	Diesel
1.	Ex-Refinery CIF Price	4.70	3.90
2.	Taxes and Duties	5.02	1.00
3.	Distribution (Expenses)	0.78	0.61
4.	Retail Price	10.50	5.50
5.	Economic Cost (1+3)	5.48	4.51

Source: Based on formula used for price fixation by Fuel, Power and Natural Resources Division, Government of Pakistan.

It would be seen from table 1 that tax rates both for petrol and diesel vehicles are the same at about 70 percent advalorem. However, in the case of petrol, the tax is more than 80 percent of value as against 25 percent for diesel.

A distinction has been made between prices and economic costs. Prices include all taxes and transfer payments which are excluded from economic costs as these do not represent the use of real resources. However, only taxes and subsidies within the national economy are taken into account; taxes and subsidies in the foreign sector are not considered. The later represent costs to the national economy. Besides, only first-round direct taxes, subsidies, and transfer payments are excluded. Subsequent shifting of incidence is not considered. For example, freight charges may include an element of subsidy or tax by a third-party. Similarly, port charges may also include some tax or subsidy. These are not taken into account to keep the analysis simple. The effects of such taxes and subsidies would be quite small and would not have any significant effect on our results.

Operating Costs

On the basis of the costs and prices given in table 1 and 2 the operating costs of petrol and diesel wagons are calculated in Table 3. Both costs per mile as well as net present value of costs over the life of the vehicle are shown in this table. The computed costs include capital and fuel costs only. All other costs e.g. oil, wear and tear, maintenance, wages and salaries of drivers, road taxes etc., have not been taken into account. As these will be the same for the two types of vehicles, their relative position would not be effected by this omission.

Table 3

Vehicle and Fuel Costs of Petrol and Diesel Wagons

Item	Excluding Taxes		Including Taxes	
	Petrol	Diesel	Petrol	Diesel
Per Mile Costs (Paisa)				
Vehicle Costs	19.40	28.77	33.02	50.17
Fuel Costs	25.00	20.45	47.73	25.00
Total:	44.40	49.22	80.75	75.17
NPV of Overall Costs (Rs.)				
Capital Costs	29,082	43,112	49,489	75,184
Fuel Costs Discounted	36,630	29,970	69,930	36,630
Total:	65,712	73,082	119,419	111,814

Discounting of Futures Cost

A brief explanation of the method of estimating costs is also necessary here. It is evident that the cost of a vehicle will be incurred today and recovered over a number of years. Similarly, fuel costs will be incurred over a number of years. The present value of a sum of money to be incurred or received a few years hence is less than its face value depending upon the rate of interest. The spread of costs over a number of years raises the problem of determining real values in present terms. This problem can be resolved by discounting the future stream of money to be spent or to be recovered by the appropriate rate of interest.

For discounting purposes a monthly time interval has been selected for the reason that this is the usual accounting period for commercial operation of vehicles.

Accordingly, per mile capital cost has been estimated by assuming that capital carries an annual interest of 12 percent and will be recovered in 60 equal monthly instalments.[1] Dividing the monthly instalment by average monthly mileage of 3333, gives per mile capital cost of the vehicle. This figure is higher than if the capital cost was divided by lifetime mileage due to the fact that element of interest on capital is also taken into account (future costs have been discounted).

Similarly, in the case of NPV of overall costs, costs of fuel that will be incurred over the life of the vehicles have been calculated by discounting monthly expenditure on fuel at a 12 percent annual rate.

Main Features of Relative Costs

It would be seen from table 3 that excluding taxes, the per mile overall operating costs of diesel wagons are 11 percent higher than petrol-wagons. However, after tax, per mile and overall operating costs of diesel wagons are about 7 percent lower than petrol wagons. The difference of Paisa 4.55 in per mile fuel costs increases to 22.73 due to the higher tax on petrol. Before tax, the overall savings in fuel costs of diesel wagons over the life of a vehicle (Rs. 6,660) are less than half the extra initial costs of the vehicle (Rs. 14,030). However, after tax, the lifetime savings in fuel costs (Rs. 33,300) are 30% more than the extra initial costs (Rs. 25,695).

In real terms, the 11 percent extra cost of a diesel wagon turns into 6.4 percent saving for the operator in financial terms. The net present value of the burden of the tax on a petrol wagon over its life is 38.7 percent higher than on diesel wagons (Rs. 53,707 as against Rs. 38,732).

Distortions

The above finding indicates that the use of high cost diesel vehicles is being encouraged disproportionately. There is a clear conflict between the private and social costs. The economy pays Rs. 73,082 for the services of a vehicle which would otherwise cost Rs. 65,712 if there is no distortion in the

[1]This is obtained by the formula $i(1+i)^n/(1+i)^n-1$, where i = interest, and n = number of instalments. With 12 percent interest and 5 years period of repayment in monthly instalments, $i=0.01$ (1 percent per month) and $n=60$ instalments.

relative costs. There is a net loss of Rs. 7,370 per vehicle to the economy. Due to this distortion, relatively fewer petrol wagons are seen on the road. Particularly, the commercial sector is dominated by diesel wagons.

The disproportionate encouragement of the diesel wagons leads to an imbalance in the demand for petrol and diesel, a shortage of diesel, and problems for the disposal of surplus petrol. The production mix of crude oil, which depends upon its chemical qualities, cannot be varied at the refinery level except within a very narrow margin and at a higher cost. The present production mix and demand of various by-products at given prices are such that diesel falls short of requirements whereas petrol becomes surplus. During 1974-75, 3,398,000 tons of crude and 187,000 tons of diesel were imported and 708,000 tons of surplus petrol was exported[2]. A ready export market for petrol is not available and competition in the international market is harder. In view of the fact that exportable surplus petrol has to meet two-way ocean freight, in import of crude oil and export of finished product, it is doubtful if any profits are earned. If the demand for POL products is balanced, less crude would be imported and there would be a net saving to the economy.

POLICY OPTIONS

The above mentioned distortions can be corrected if the overall cost ratios of two types of vehicles remain the same before and after tax. It was shown that the cost of operating a diesel wagon was 11 percent (Rs. 7,370) higher than petrol wagon before tax but about 7 percent (Rs. 7,605) lower after tax. To restore the cost ratios to before tax levels would require a difference of Rs. 20,740 in the cost of two wagons. If, however, the difference in absolute costs is restored, a variation of Rs. 14,975 would be required from (—) Rs. 7,605 to (+) Rs. 7,370. As the later proposition would be less drastic in its effect on relative costs, it may be pursued further. The required change can be brought by varying one or a combination of : cost of petrol and diesel; quarterly taxes; and import duties on vehicles. The potential of each method is examined below.

Variation in the price of petrol and diesel.—It would be an ideal solution if prices of petrol and diesel could be brought in line with their relative costs. However, petrol is mostly used by private cars and duties on it are a sort of sumptuary tax. Reduction in its price would therefore not be acceptable from the point of view of tax revenue. On the other hand, diesel is used by public service vehicles, railways and for industrial purposes. Any change in its price for correcting the distortion in the use of station wagons would not be desirable. The differentiation in fuel prices for various uses or various types of vehicle is also not possible.

Variation in quarterly taxes.—At present, commercial vehicles are taxed on the basis of seating capacity: Rs. 26 per seat per quarter. We have assumed a vehicle life of 5 years over which the total quarterly tax would amount to Rs. 6,240. An increase of more than 200 percent would be required to modify relative costs to the extent desired. Such a substantial increase may not be possible on account of socio-political considerations. Therefore, the scope for vari-

[2]Published data from traffic handled by the Port of Karachi.

ation in the quarterly taxes is marginal. Possibly some rebate can be given to petrol wagons and or some surcharge can be levied on diesel wagons. As the number of petrol wagons in use is much smaller than that of diesel wagons, there will be an increase in tax revenues on balance.

Variation in import duties.—This is administratively more convenient and can be easily achieved. At present, the total import duty on a petrol station wagon is Rs. 11,745 (Table 1). Its price is around the price of a medium-size car on which there is a duty of 130 percent. A reduction in duty would reduce its price and may encourage its substitution for cars.

This would again be a misuse of resources. Therefore, the scope of variation of duty on petrol wagons is marginal. Alternatively, the tax on diesel wagons may be increased. The CIF value of a diesel wagon is Rs. 29,514 and present duties are Rs. 18,778 (57 percent table 1). A further increase in tax can be brought about in this time. This would not be the best solution as it would not directly effect the running costs of diesel wagons. The operators once having invested their money in the vehicle would be mainly concerned with their running expenses and the perceived costs of diesel wagons would still be lower than petrol wagons. Nevertheless it provides the second best solution.

It would appear from the above that variation in fuel costs is out of the question. The scope for alteration in quarterly taxes is also marginal. Therefore, a combination of a variation in quarterly taxes and an increase in import duties on diesel wagons would be appropriate. A 20 percent rebate on the quarterly tax on petrol wagons and a similar surcharge on diesel wagons is suggested. This would change the quarterly tax on petrol and diesel wagons from Rs. 312 to Rs. 250 on petrol and Rs. 375 for diesel wagons respectively. The resulting difference of Rs. 125 per quarter would amount to a total difference of Rs. 2,500 in the overall operating costs of the two types of vehicles over their 5 year life. The remaining difference of Rs. 12,500 may be brought about by increasing the import duties on diesel wagons from Rs. 18,776 to about Rs. 31,278. This would be about 88 percent of CIF value as aginst the present rate of 57 percent. The overall operating cost of diesel wagon which is 11 percent higher before tax, will be, 7.3 percent higher after tax. The absolute difference will be the same as before tax.

Effect on Fares

The effect of the proposed increase in taxes is not likely to be significant on fares. The increase of Rs. 15,000 in the cost of diesel wagons would amount to Paisa 7.5 per vehicle mile or 0.6 Paisa per passenger mile. This is insignificant against the present average fare of Paisa 10 per passenger mile charged by wagons. The operators prefer fares in round figures; as such no increase is likely to result, particularly on short urban routes. On long intercity routes, of say 175 miles between Lahore and Rawalpindi, the fare may increase by Rs. 1 per passenger.

Traffic Distribution—Petrol Versus Diesel Wagons

The standing cost of a petrol wagon is lower than a diesel wagon because of lower capital costs. The correction of price distortion would encourage the use of petrol wagons at places where traffic is not regular and more waiting time

is required. Thus the distribution of traffic between petrol and diesel wagons would be encouraged in line with their relative costs.

Wagons Versus Buses

The main merit of a wagon is the quality of service which is in between a private car and bus. Although there is demand for this type of service, but diversion of some traffic to buses is a desirable policy objective for several reasons. The cost of a diesel wagon is about half the cost of a bus but its passenger carrying capacity is one fifth only. They require more road space as compared to buses for carrying the same number of passengers. Besides, station wagons in urban areas, particularly on busy roads are also responsible for traffic hazards by chasing each other for getting passengers, crossing lanes and frequently stopping for boarding and alighting passengers and create congestion making the road space more scarce. The increase in the cost of diesel wagons will reduce their supply and divert some traffic to buses provided the supply of buses is increased correspondingly. To the extent this happens, there would be savings in investment on vehicles as a given amount of capital would procure two to three times seating capacity if buses are used in place of wagons. Besides, less investment would be required on roads.

CONCLUSION

The foregoing analysis shows the anomalies that can arise from tax policies when relative costs are effected and indicates the way how such anomalies can be removed. The adjustments proposed in taxes and duties are only indicative. What the analysis tries to show is that there is a need to increase the tax on diesel wagons so that relative cost advantages gained by them due to the existing lower tax on diesel do not lead to their substitution for petrol wagons and buses which cost less in real terms, but are put at a relatively disadvantageous position due to the tax distortion. Adequate data is not available to allow precise estimation of the magnitude of savings. Nevertheless, the resulting changes in operating costs of petrol and diesel wagons on the basis of their relative economics would replace high cost diesel vehicles and require less investment on vehicles. There will also be some balance in the demand for petrol and diesel in the country. Besides, possible diversion of some traffic to buses will cause less demand for road space. The overall savings to the economy would be considerable.