

PRICING POLICY OF AUTO-FUEL: THE CASE OF SRI LANKA

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Abstract

Pricing of auto-fuel (petrol and diesel) has been a subject of debate among policy makers, administrators, politicians and multilateral agencies in Sri Lanka. Auto fuel pricing policies adopted by successive governments over the past four decades have been influenced by welfare oriented political economy considerations rather than market factors and environmental considerations. This has led to significant changes in the structure of vehicle population, fuel consumption patterns and vehicular emission levels. This paper deals with these issues with special emphasis on distributional and environmental implications of auto-fuel pricing.

Introduction

Sri Lanka is a developing economy with a total population of 19.5 million and per capita income of US\$ 1031 (2004). Its total vehicle population and road network in 2002 is about 1.273 million and 19 million kms respectively. The continued practice of pro-market policy reforms since 1977 has resulted in major structural changes of the national economy. Similar changes could also be noticed with respect to the structure of vehicle population and auto fuel consumption (petrol and diesel). Consequently, social costs have emerged as an important factor in fixing prices for auto fuel. The supply of auto fuel however, had been in the hands of Ceylon Petroleum Corporation (CPC), which was a state monopoly until the petroleum sector was fully liberalized in 2002. The purpose of this paper is to examine pricing of auto-fuel in Sri Lanka paying particular attention to private and social costs associated with auto fuel consumption.

The paper is organized into five main sections. Section 2 deals with growth of vehicle population and changes in auto fuel consumption over the past four decades. Section 3 presents an analysis of taxes and prices of auto-fuel while Section 4 and 5 deal with welfare implications and environmental costs of auto-fuel consumption respectively. Summary and conclusions are given in Section 6.

Growth of vehicle population and auto fuel consumption in Sri Lanka

The structural changes of vehicle population (TVP) over the past four decades are analyzed in Table 1 and 2. The evidence clearly indicates the relative share of diesel-powered vehicles (DPV) has increased from 7 to 29 percent between 1960 and 2002 as against a declining trend of relative shares by petrol-powered vehicles (PPV). In fact, without motor cycles (MCs) the relative share of PPVs has reduced from 80 to 24 percent during the same period (Table 1). As can be seen from the analysis given in Table 2, MCs account for about 68 percent of total PPV. It also indicates that the relative share of

petrol-powered cars have remained stagnant over the past four decades while that of other categories of PPV

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have reduced significantly. It is also important to note that diesel-powered dual-purpose¹ vehicles have increased its relative share accounting for about 36 percent of total diesel powered vehicles.

Table 1
Structure of Vehicle Population - %

Vehicle type	1960	1970	1980	1990	2002
Relative Share of total Petrol Vehicles	92.84	81.19	74.38	76.97	71.41
Relative Share of total Diesel Vehicles	7.16	18.81	25.62	23.03	28.6
Relative Share of total MCs	13.20	13.06	25.03	48.26	47.14
Relative Share of total Petrol Vehicles without MCs	79.65	68.13	49.35	28.72	24.27

Sources of basic data: Kumarage (2000) and Registrar of Motor Vehicles

Table 2
Structure of Vehicle Population

Vehicle type	1960	1970	1980	1990	2002
MCs (P)	14	16	34	63	68
Cars (P)	63	61	47	26	17
Dual Purpose (P)	0	0	1	1	0.6
Buses & Lorries (P)	21	21	15	8	3
Land vehicles (P)	2	2	3	1	0.4
3 Wheelers (P)	0	0	0	1	11
Total (P)	100	100	100	100	100
Cars (D)	1	2	2	3	5
Dual Purpose (D)	0	0	12	31	36

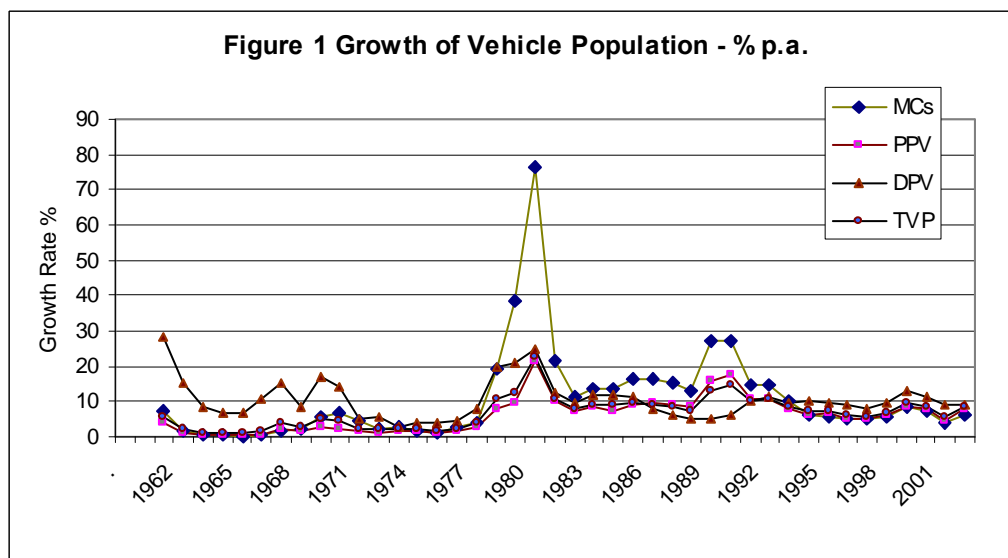
¹ Refers to Pick-ups, double cabs, Jeeps, Pajeros, small vans etc. This could also be defined as light duty vehicles.

Buses & Lorries (D)	88	66	50	37	35
Land vehicles (D)	11	32	36	29	24
Total (D)	100	100	100	100	100

Sources of basic data: Kumarage (2000) and Registrar of Motor Vehicles

D= Diesel, P = Petrol

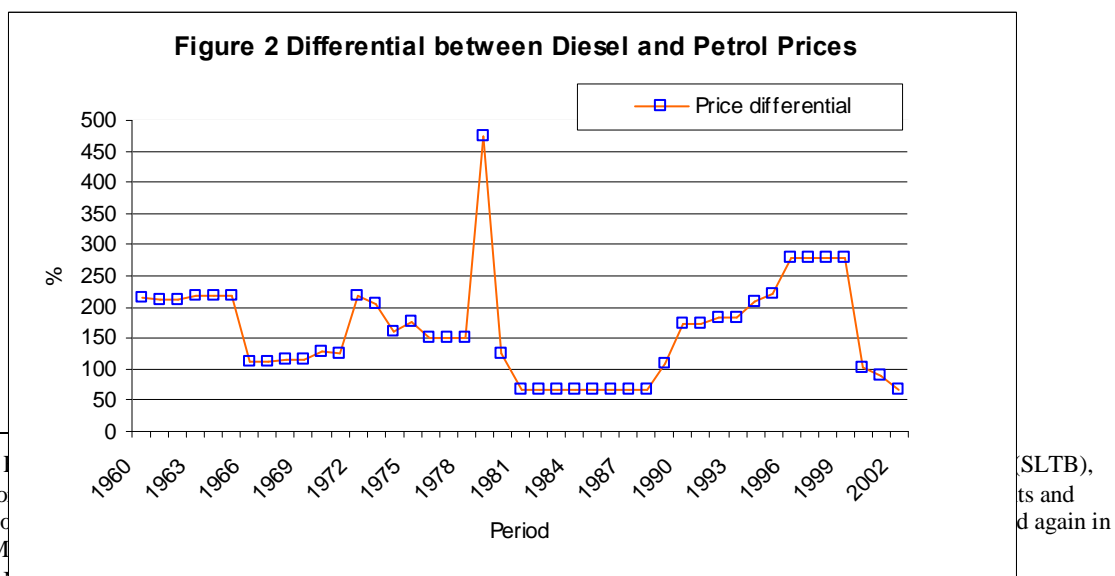
Figure 1 is an attempt to analyze growth of vehicle population in terms of major categories of vehicles. The evidence reveals that both petrol and diesel vehicles have recorded a rapid increase immediately after the introduction of liberalized economic policies in 1977. From a historical perspective, slow growth of vehicle population during the 1970s shows the impact of an inward-looking policy regime, which existed from 1970 to 1977². In contrast, during the post-liberalization period, the vehicle population records an upward trend. More specifically, the first upward trend of vehicle population in the late 1970s and the second, in the late 1980s shows the impact of two consecutive policy reform initiatives under the pro-market policy regime.³ During this period, the MCs have recorded a phenomenal growth as against other major categories of vehicles. It is also interesting to note that growth of petrol vehicles except MCs have been at 5 percent while diesel-powered cars and trucks grew at about 6 percent, slightly above the real GDP growth. In contrast, diesel-powered dual-purpose vehicles grew at a rate of 8-9 percent per annum.



² During this time real GDP growth was around 2.9 percent per annum as against 4.7 percent during the post liberalization period (1978-2002).

³ Refers to first wave of liberalization from 1977 to 1988, and the second wave of liberalization from 1989 to 1994.

The explanation for structural changes and growth of vehicle population in Sri Lanka is rather complex. In broad terms, it could be attributed to three major factors: a) duty structure on vehicle imports, b) duty concessions for selected user groups⁴, and c) pricing policy of auto-fuel. The demand for vehicles in Sri Lanka is entirely met by imports comprising of used (75%) and brand new (25%) vehicles⁵. The latter includes import of brand new cars, light vehicles and body kits and chassis. Similar to many other countries, the import of both used and brand new vehicles to Sri Lanka are subject to import duty, excise duty, stamp duty and other taxes such as turnover tax and value added tax⁶. For example, in the 1980s and 1990s all types of vehicle imports were subject to customs duty, turnover tax, national security levy and stamp duty. In addition, import of diesel powered cars and dual-purpose were subject to an excise duty of 50 and 35 percent respectively. The applicable duty rates across different categories of vehicles however vary quite significantly depending on engine size, type of fuel, year of manufacture and extra items such as air conditioning, stereo sets, power steering etc. The import of used or reconditioned vehicles are also subject to a maximum age limit of 3 years for cars and 5 years for dual-purpose vehicles. This disparity has resulted diesel powered dual-purpose vehicles as a cheaper option and close substitute for petrol cars mainly due to low CIF value and pricing policy of auto-fuel. As shown in Figure 2, the price differential between petrol and diesel in Sri Lanka is much higher than the international average of 40 percent price differential (Bacon, 2001).

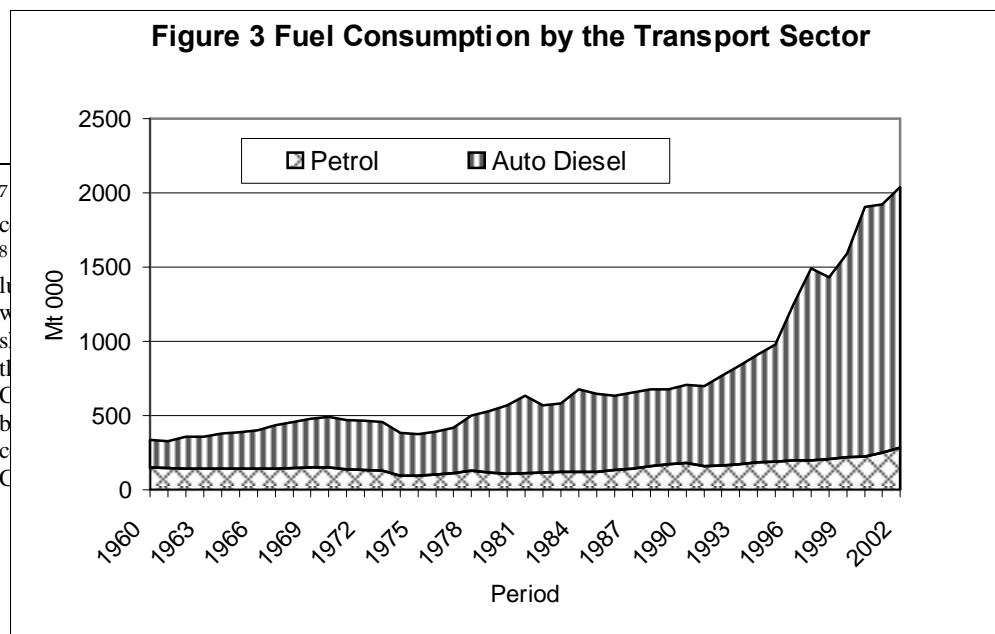


⁴ Micro Cars Pvt. Ltd. started assembly of cars in small scale in 2004.

⁶ VAT came into operation on August 1, 2002 with the introduction of Value Added Tax Act, No. 14 of 2002. It replaced National Security Levy (NSL) and Goods and Services Tax (GST).

Taxes and prices of auto fuel

In response to structural changes of vehicle population, auto-fuel consumption has also changed during the post-liberalization period. As evident from Figure 3, petrol consumption has remained stable over the last four decades except for a marginal increase in the 1990s. In contrast, auto-diesel consumption⁷ has recorded a significant increase during the post liberalization period particularly since the mid-1990s. Sri Lanka imports its entire requirement of petroleum fuels, and up to 2002, the CPC continued as the sole importer and distributor of auto fuel. With the enactment of the Petroleum Products (Special Provisions) Act No. 23 of 2002, the import and sale of petroleum products were also liberalized⁸. Most recent development in this regard is the introduction of Petroleum Resources Bill (June 2003) vesting ownership of petroleum resources to the state but allowing partnership with the private sector institutions. Accordingly, the entry of Indian Oil Corporation (IOC) with 100 filling stations to petroleum retail market in July 2003 is an invitation for several other big players in the international petrochemical industry. In fact, Indian state-run Oil and Natural Gas Corporation (ONGC), Caltex Lubricants Lanka Ltd (Caltex) and Shell Gas Lanka Ltd have also expressed their interest in entering the local petroleum market.



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It is necessary to examine the pricing policy of auto-fuel from a historical perspective mainly to understand the pricing mechanism under a state monopoly. The CPC, being a semi-government organization, was required to obtain the approval of its Supervising Ministry⁹ and the Central Treasury for any price revisions. From the point of view of the government, the purpose was to ensure fulfillment of both economic and commercial objectives expected from a public sector enterprise (PEs) operating in a key sub-sector of the national economy. On one hand, the CPC is so vital to the government due to its revenue generating capacity and on the other, its relative significance in promoting social welfare. The first, revenue contribution to the government, is met by various indirect tax payments such as import duty, excise duty, stamp duty, value added tax, turnover tax and security levy. It also includes direct taxes such as income tax, dividends and other levies imposed on PEs. For example, in terms of the Inland Revenue Act No. 28 of 1979, PEs are required to pay income tax on profits at a rate of 50 percent. Similarly, in terms of Section 8(2) of the Inland Revenue (Amendment) Act No. 56 of 1985, PEs are required to pay to the Inland Revenue Department a dividend at a rate of 25 percent after tax profit, beginning from 1986¹⁰. Payments under other levies include the kerosene subsidy and special levy of Rs. 500 million to the Central Treasury. The latter was to siphon off into the Treasury a part of the windfall profit made by the CPC as a result of the decline in the world price of oil. The kerosene subsidy was mainly to support a subsidy paid by the government to households whose income is under Rs.8400/= per annum. In 1986,

⁹ From the inception upto 1987 the CPC functioned under supervision of the Ministry of Industries and Scientific Affairs and in 1987, it was placed under supervision of the Ministry of Power and Energy.

¹⁰ In 1986, the amount paid as dividends was Rs. 114.5 million.



this was calculated at a rate of Rs. 12.23 per household per month for 1,575,000 households.

The second objective, promoting social welfare, has been a major concern of successive governments over the past four decades in view of the direct impact of auto-diesel price over the cost of freight and public transport. In fact, pricing of auto-diesel has become a major concern among policy makers, politicians, vehicle owners and the common public. Because of these complex factors, the pricing of auto-fuel produced at the refinery, and imported from the Singapore spot market, is extremely complicated and lacks transparency. This aspect however, would be analyzed in detail considering various tax obligations and other cost items.

The customs duty and other taxes applicable to petroleum products between 1983 and 2000 are summarized in Appendix 1 and 2. It clearly shows the discrimination of petrol users against auto-diesel users through different tax structures. For example, excise duty on petrol remained much higher than that of diesel and crude oil between 1983 and 2000. According to tax revisions introduced in January 2001, excise duty applicable to petrol and diesel was Rs. 24 and Rs. 4 per liter respectively. With the introduction of Value Added Tax (VAT) system in 2003, excise duty on petrol and diesel was reduced to Rs. 21 and Rs. 3 per liter respectively. These changes further confirm the government's policy of treating petrol users as a potential target group for revenue generation.

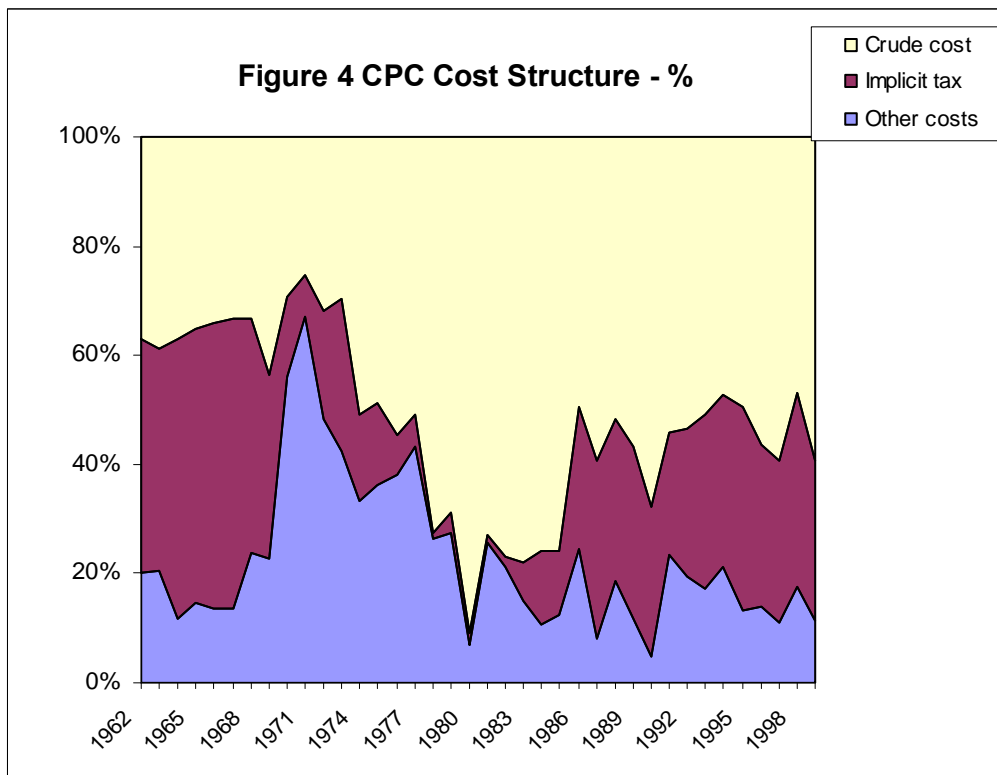
The analysis given in Table 3 is an attempt to examine this aspect in detail. It deals with the price structure of petrol and auto-diesel and the evidence reveals that the cost of production of petrol including customs duty is Rs. 34.23 per litre in 2000. With the addition of excise duty and security levy of Rs. 16.21, the total cost raises upto Rs. 50.44 per liter. In the case of diesel, the total cost is about Rs. 30.96 per liter representing the cost of production (Rs. 23.99) and excise duty and security levy (Rs. 6.97). Accordingly, the CPC was incurring a loss of Rs. 0.44 and Rs. 9.46 per liter of petrol and diesel respectively in 2000. Based on the same methodology, the CPC was making a profit of Rs. 12.70 per liter of petrol and a loss of Rs. 1.75 per liter of diesel in 1996¹¹. In terms of explicit tax revenue, the government was collecting Rs. 28.71 and 12.35 per liter of petrol and diesel respectively in 2000 and, Rs.17.94 and Rs. 5.12 per liter of petrol and diesel respectively in 1996. From a national point of view, all tax payments are revenue to the government, and hence could be treated as a single attribute when examining welfare considerations of auto fuel pricing. As shown in Figure 4, explicit tax payments account for a sizable proportion of the total cost structure of the CPC.

¹¹ In 1996, the CPC incurred heavy losses with respect to all its major product items except for petrol.

Table 3
Price Structure of Auto Fuel (Rs/L) - 2000

	Petrol	Diesel
Landed cost	18.97	16.11
Customs duty @ 25 % on CIF	12.5	5.38
Manufacturing and administration O/H, Distribution margin & Financial charges	2.70	2.50
Cost of production	34.23	23.99
Excise duty & Defense levy	16.21	6.97
Total cost	50.44	30.96
Selling Price	50.00	21.50
Profit/loss	-0.44	-9.46

Notes: Excise duty 35% calculated as 35/135 on selling price and Defense levy calculated as 6.5% on selling price. Crude imports at US\$ 30/bbl.



Under this policy regime, the CPC was not allowed to increase the domestic prices for petroleum products to recover the full cost of oil procurements due to increases in international oil prices and depreciation of the Sri Lankan Rupee against US\$. In other words, the government did not recognize losses due to oil price increases in international markets and exchange rate fluctuations as factors affecting the pricing policy of auto fuel. For example, in 1976, the CPC reported a net loss of Rs. 78.3 million representing a loss of Rs. 226.6 million from domestic sales and a profit of Rs. 148.3 from other activities such as sale of marine and aviation fuel, refinery production and blending plant production. In the total revenue mix of the CPC, domestic sales account for about 89 percent of the total turnover representing sale of petrol (32%), auto-diesel (49%), heavy diesel, furnace oil, kerosene and naphtha. As a consequence, the CPC had to incur heavy losses on its domestic sales together with high cost of interest payments for additional borrowings. In operational terms however, this did not affect the CPC, as there is legal provision for government subsidies to recover the financial losses of PEs. For example, Section 17 of Finance Act No. 38 of 1971, stated that "a public corporation may be entitled to claim a subsidy from the Government for any year if as a result of any decision of the Government or any directives issued by the appropriate Minister the governing of the corporation is prevented from determining during any particular period a pricing policy for the corporations to meet the financial obligations referred to in Section 7ö.

From the above account it is explicit that under this policy regime, the final decision on auto-fuel pricing was taken by the government and the CPC was not allowed to run as an independent business entity. For example, in 1986, when international oil prices were down, the CPC was in a position to reduce the price of all petroleum products. However, the CPC was not allowed to reduce the price of petroleum products except for furnace oil as the government increased the customs duty from 5 to 45 percent. Accordingly, the CPC was able to reduce only the price of furnace oil by one rupee a liter. In fact, successive governments in the 1990s appear to have given more weightage to political economy factors rather than real economic factors in fixing prices for auto-fuel. As a result the accumulated financial losses of the CPC reached Rs. 16,682 millions in 2000¹².

In view of the instability in the oil market and accumulated financial losses of the CPC, the government was compelled to introduce major changes to its pricing policy of auto-fuel. The new pricing policy introduced in 2002, was based on a pricing formula that captures price fluctuations in the international oil market, movements in exchange rates, duties and taxes and production and distribution costs of the CPC. More specifically, it includes six cost components: a) CIF prices of fuel based on spot prices in Singapore, b)

¹² It is worth noting that organizational inefficiencies of the CPC should also be taken into account in analyzing its heavy financial losses. Present study however, deals with policy related issues only.

exchange rate fluctuations (Rs:US \$), c) terminal costs at Colombo port, d) duties and taxes, e) CPC debt recovery charges, f) CPC wholesale costs and retail/distribution costs. According to the new pricing formula, prices of petroleum products are to be revised on monthly basis¹³. Of major cost components included in the proposed price formula, most controversial issue was the debt recovery charges of Rs. 6.00 and Rs. 3.50 per litre of petrol and diesel respectively. There was however, strong objections to this suggestion on the grounds of taxing future consumers with the inefficiency costs of past policy regimes. On the other hand, if it is to be borne by the government then, it has to be collected through various other direct and indirect taxes. After some debate over this issue, the government decided to implement the new pricing policy with effect from February 1st 2002 leaving out debt recovery component completely.

The analysis given in Table 4 is an attempt to examine fiscal implications of the new price formula for petrol and diesel. The findings reveal that the explicit tax revenue per liter of petrol and diesel was Rs. 25.74 and Rs. 5.36 respectively in 2000. With the introduction of Value Added Tax (VAT) in August 2002, the price structure of auto fuel changed marginally and implicit tax revenue to the government per liter of petrol and diesel stood at Rs.24.41 and Rs. 3.21 respectively (Table 5). During the wartime in the Middle East (1st quarter 2003) however, the government did not allow the CPC to adjust fuel prices using import parity price formula considering its direct impact on passenger and goods transport sector especially when the country's major exports (tea, garments etc..) were badly affected. Consequently, the entire losses due to high prices in international markets had to be met by the government. Similarly, in late 2004 and early 2005 fuel prices were not allowed to increase in spite of significant increases in international fuel prices. This is similar to the earlier policy of providing government subsidies to recover operational losses of the CPC. With the entry of multinational enterprises (MNE) however, the government need to be very clear and precise with respect to its policy on auto-fuel pricing.

Table 4
Auto Fuel Pricing based on Import Parity Price Formula (1/2/2002) (Rs/lit)

Cost element	Petrol	Diesel
Cost of production (cop)	19.00	16.84
Notional profit @ 5% of cop	0.95	0.84
Excise duty	24.0	4.0
Wholesale price	43.95	21.68
Dealer margin	0.55	0.26

¹³ This has been assigned to a Petroleum Price Board comprising of representatives from the Ministry of Finance, the Ministry of Power and Energy, CPC and two non-governmental representatives.

National Security Levy	1.30	1.14
Turnover tax	0.44	0.22
Total	46.24	23.30
Retail price	49.0	26.0
Profit/loss	2.76	2.70
Total implicit tax revenue	25.74	5.36

Source: CPC

Table 5
Auto Fuel Pricing based on Import Parity Price Formula and VAT (1/8/2002)
(Rs/lit)

Cost element	Petrol	Diesel
Cost of production (cop)	19.00	16.84
Notional profit @ 5% of cop	0.95	0.84
Excise duty	21.0	3.0
Wholesale price	40.95	20.68
Dealer margin	0.55	0.26
Turnover tax	0.41	0.21
Value Added tax	3.00	1.00
Total	44.91	22.15
Retail price	50.0	30.00
Profit/loss	+5.09	+7.85
Total implicit tax revenue	24.41	3.21

Source: CPC

Welfare implications

This section makes an attempt to examine welfare implications of auto-fuel pricing. The assessment begins with the aggregate demand for auto-fuel since it is fundamental to the efficacy of tax instruments. Most of the elasticity estimates for petrol and diesel relating to many countries including Sri Lanka indicate wide variations. Several attempts have been made to estimate the price elasticities of aggregate auto fuel demand in Sri Lanka¹⁴ and many of the earlier studies however, are limited to a period of 15 years from 1970 to 1985 and therefore, do not capture the effects of major changes in road transport sector during the post liberalization period. Meier *et al.* (1993) employed vehicle use lagged endogenous model which models auto fuel demand as the autoregressive function and allows separate estimation of long and short-run elasticities. Based on this methodology, the estimated elasticity values for petrol were 0.14 and 0.334 for long and short run periods respectively. Work by Jayaweera (1999) produced elasticity values of 0.163

¹⁴ For details see IDEA (2002) and Chandrasiri (1999).

(long run) and 0.115 (short run) for petrol and 0.339 (long run) and 0.154 (short run) for diesel.

Since petrol and diesel are partial substitutes, rigorous estimation of price effects need to take into account the relevant cross-price elasticities. This has been estimated simultaneously by Chandrasiri (2006), using Seemingly Unrelated Regression Estimate (SURE) method to a system of simultaneous equations¹⁵ and the results are reported in Table 6 below.

Table 6
Short – and long-run price elasticities for road fuel in Sri Lanka

	Petrol	Diesel
Own price ó Short-run	-.076	-.081
- Long-run	-.478	-.669
Cross price	.076	.081

Boldface: Statistically significant
Source: Chandrasiri (2006)

The results of a recent estimate of SURE model (Table 6) suggest that substantial increases in price will be necessary to discourage consumer demand for auto fuel. Accordingly, a 10 percent increase in petrol price may reduce the demand for petrol by .76 percent in the short-run and 4.8 percent in the long-run. Similarly, a 10 percent increase in diesel price may reduce the demand for diesel by .81 percent in the short-run and 6.8 percent in the long-run.

From the demand estimates given above, it is explicit that the demand for auto-fuel is inelastic. Thus, a sizable proportion of any tax increase could easily be passed on to vehicle owners especially, in the case of petrol since it could be treated as consumption good. In contrast, diesel could be treated as an intermediate good since a sizable proportion of diesel consumption (i.e. buses and lorries) is used for freight and public transport. Hence, the vehicle owners of these categories are in a position to pass the tax burden on to other user groups by raising transport charges. In Sri Lanka however, bulk of diesel-powered dual-purpose vehicles are used for private purpose and hence, any incremental taxes on auto-diesel will be met by dual-purpose vehicle owners. In fact, most of them use diesel-powered dual-purpose vehicles as a substitute for a petrol car.

¹⁵ In this technique the equations are estimated simultaneously to avoid problems when the error terms across equations are correlated, which is the case in fuel demand equations linked by cross-price elasticities. The restricted version of the SURE model especially, can be used to estimate the systems of equations subject to general linear restrictions, including linear cross-equation restrictions (Pesaran and Pesaran, 1997).

In developing countries taxes on petrol have been considered as an attractive way of taxing the expenditure of high-income segment of the population. Hence, petrol is taxed on revenue raising or redistributive grounds. In contrast, taxes on diesel fuel have been recognized as an effective way of promoting social welfare as it is properly used in commercial vehicles as an intermediate input into production rather than final consumption. Thus, diesel is typically taxed at a lower rate. In Sri Lankan context, that may have been the case before liberalization, when car ownership was indeed limited to a very small segment, and diesel vehicles limited to buses, trucks and tractors. It was also noted that MCs have recorded the highest growth among petrol vehicles while D/Ps have recorded the highest growth among diesel vehicles. As noted earlier, existing duty structure on vehicle imports encourages vehicle owners to avoid heavy petrol taxes by buying diesel vehicles. In order to arrest this situation the government introduced other charges such as registration fees and user charges. Earlier efforts of introducing other tax schemes such as diesel tax were rather ineffective in discouraging the high imports of diesel powered dual-purpose vehicles. In fact, it led to various administrative problems and malpractices resulting the termination of diesel tax with effect from 1999. The end result was continued increase of diesel driven dual-purpose vehicles or dieselization of dual-purpose vehicles.

Table 7
Fuel Consumption by the Transport Sector

Vehicle type	FC (000 tons)	%	Vehicle type	FC (000 tons)	%
MCs & 2S (P)	18	8.49	Car (D)	29	3.10
MC- 4S (P)	35	16.51	Dual (D)	298	31.87
Car (P)	94	44.34	Bus (D)	219	23.42
D/P (P)	15	7.07	Lorry (D)	351	37.54
Land (P)	1	0.47	Land (D)	36	3.85
3 Wheeler (P)	49	23.11	3 Wheeler (D)	2	0.21
Total (P)	212	100.0	Total (D)	936	100.0

Source: ESMAP (2002)

FC = Fuel consumption; D= Diesel; P= Petrol

As shown in Table 7, gasoline cars account for about 44.34 percent of total gasoline consumption while motorcycles and 3-wheelers account for about 48.11 percent, which mainly provides personal transportation facilities for a lower income segment of the population. In contrast, diesel-powered dual-purpose vehicles account for about 32 percent of total diesel consumption and bulk of which belong to high-income earners of the population. As noted earlier, existing fuel taxes and the age limit of 5 years on second hand dual-purpose vehicles unduly encourage import of diesel-powered vehicles. In short, there is no evidence that the present tax structure on transportation fuels is progressive. In fact, the present tax structure disproportionately favors the better off &

most importantly the owners of so-called dual-purpose vehicles, whose consumption of diesel (219,000 tons in 2000) exceeds the total consumption of petrol.

As stated earlier, the pricing formula introduced in January 2002 was designed to absorb fluctuations in international fuel prices by adjusting domestic prices on monthly basis. The failure to adopt this pricing strategy has resulted in provision of heavy subsidies to petroleum companies. According to most recent estimates, a subsidy of one Rupee on a litre of petrol, diesel and kerosene amounts to a subsidy of Rs. 2.6 billion per annum. The total subsidy commitments by the government to petroleum companies amounted to Rs. 18 billion or about 0.9 percent of the GDP in 2004¹⁶. The financing of subsidies will have to be met by an increase in indirect taxes (i.e. VAT) or cut down public expenditure elsewhere, or from the borrowings. On one hand, all these options will have an immediate negative impact on low-income earners of the society and on the other, a larger proportion of the subsidy diverted to road fuel sector would go to the hands of the high income earners as a large proportion of diesel vehicles are owned by them. In fact, subsidizing public transport system would be far more beneficial to the low income earners of the society rather than subsidizing auto-diesel.

2. Environmental impact

In addition to the distributional rationale, there is also an environmental rationale associated with auto-fuel pricing. In the case of petrol driven vehicles, the main local air emission of concern in Sri Lanka is lead, and particulates from 2-stroke engines. A recent report by the National Building Research Organization (NBRO, 2003) revealed that there has been a significant reduction in total ambient lead levels with complete banning of unleaded petrol since 1997. Accordingly, total ambient lead levels have reduced by more than 90 percent between a period of 10 years from 1993 to 2003. For example, the average concentration of ambient total lead ($\mu\text{g}/\text{m}^3$)¹⁷ reduced from 206.82 in October 1993 to 28.81 in December 2002. Another data set compiled by the NBRO (2003) covering 3 monitoring stations in Colombo also revealed significant reductions in lead levels from May to December, 2002. Hence, the main local air emissions problem at present is from diesel-powered vehicles.

The most recent study on health effects of lead was undertaken by Wijayamuni (2002) based on a sample of 64 traffic policemen and a control group of another 64 non-traffic policemen. The average blood lead levels (BLL) for traffic and non-traffic policemen were 7.470 $\mu\text{g}/\text{dl}$ and 7.059 $\mu\text{g}/\text{dl}$ respectively. The difference between traffic and non-traffic policemen was found to be statistically insignificant and on comparative basis it is

¹⁶ Central Bank Annual Report, 2004. p.14.

¹⁷ μg =micrograms

about 86 percent reduction as against the mean BLL of 53.07 $\mu\text{g/dl}$ (i.e. traffic policemen) reported by Arewgoda (1992). This means over a period of 10 years there has been a marked decrease of BLL in Colombo and the current BLL is well within the WHO safety limits. In terms of health benefits the study concludes that the health impact could be enormous and the economic benefit of the decision taken to phase out lead from Sri Lanka clearly outweighs the cost of abatement.

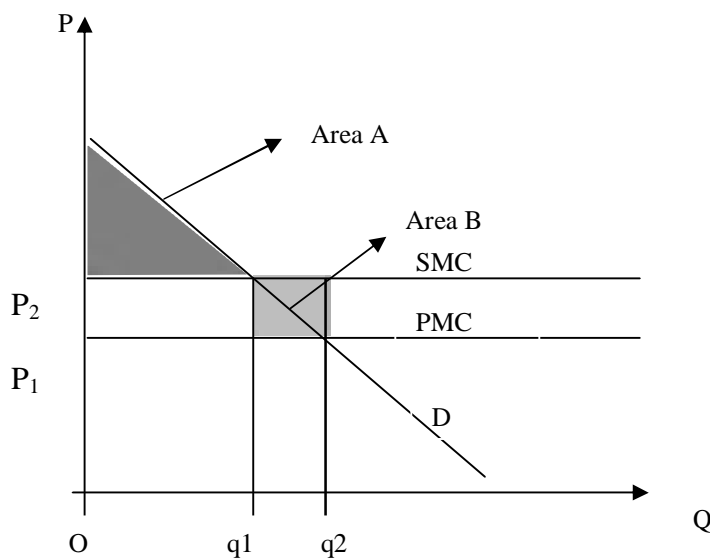
The other pollutants affecting ambient air quality levels in Colombo include SO_2 , particulate matter (PM), NO_2 , CO, Ozone and Toxics. Of these, the air pollutant of greatest concern to public health is particulate matter of size 2.5 and 10 microns ($\text{PM}_{2.5}$ and PM_{10}). The evidence of Continuous Air quality Monitoring Programme (CAMP)¹⁸ initiated by the National Building Research Organization (NBRO) in 1989 clearly shows particulate matter as a major pollutant in Colombo. Mathes et al. (1992) further confirmed this finding by providing clear evidence in support of high correlation between total suspended particles (TSP) levels and Traffic density in Colombo. It also revealed that TSP levels in sample locations of Colombo were far above the standards recommended by the WHO. In addition, pollution estimates prepared by the Metropolitan Environmental Improvement Programme (MEIP, 1992) and Chandrasiri (1999) based on statistical estimation methodology revealed automotive emissions as an important source of air pollution in Colombo. A recent study by Air Resources Management Centre (ARMC, 2003b) noted that "qualitatively and quantitatively, however, the levels of visible smoke and fine particulate matter along major traffic routs in Colombo appear to be of the same order as those observed in other major cities". From this we consider it safe to assume that $\text{PM}_{2.5}$ concentrations in central Colombo and along major roads are high enough to present a significant risk to public health.

The above evidence clearly demonstrates the significance of environmental considerations in fixing prices for auto-fuel. This involves valuation of health damage due to vehicular emissions. Except the work by Chandrasiri and Jayasinghe (1998), there is hardly any work on health damage of vehicular emissions in Sri Lanka based on clinical data. In spite of various limitations of this study (as noted by the authors), when combined with the hospital admissions and death rate statistics, and additional surveys of patients visiting general practitioners working in Colombo, the totality of the evidence does suggest at least some linkages between particulate emissions and related health problems. As a part of their study Chandrasiri and Jayasinghe (1998) estimated the value of health damages attributable to particulates in Colombo to be in the range of Rs. 67 to 160 million/year, based on highly exposed occupational groups (Traffic wardens, trishaw drivers, traffic policemen).

¹⁸ For details on phase I and II of the CAMP see <http://www.nsf.ac.lk/nbro/enviro>

Several other studies however, have adopted the benefit-transfer method of damage valuation. It is commonly accepted that such an approach has its shortcomings, but in the absence of country specific damage valuations the only alternative is to adopt benefit transfer approach. In fact, this approach has been used in a number of recent developing country studies including Sri Lanka (ESMAP, 2003). A recent study by ARMC (2003a), noted that around 80 percent of the vehicular PM emissions come from diesel engines. In terms of different types of vehicles, heavy trucks and buses account for about half the total while D/P vehicles account for about one-sixth of the diesel PM emissions. Based on pollution damage estimation methodology developed by Lvovsky et al., (2000), ARMC (2003a) study identified PM pollution as the most serious source of vehicle pollution and estimated pollution costs to be around \$5/kg or Rs.3.2/liter of diesel including other pollutant costs. More specifically this includes PM damage cost of Rs. 1.9/litre, sulphur damage cost of Rs 0.8 /liter and Nox damage cost of Rs 0.5 /liter. This study also suggests that the Rs 3.2 /liter as a reasonable damage estimate for urban diesel and Rs 1.5 /liter as the country-wide average. In a recent study Chandrasiri (2005) estimated the externality costs of auto-diesel emissions to be in the region of Rs.22 per liter for Colombo based on a cost of illness study¹⁹.

Graph 1: Impact of SMC on diesel price



¹⁹ For more details on cost of illness study see Chandrasiri et. al., (2006).



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As stated earlier, auto-fuel pricing at present is based on CIF cost of crude imports, refinery charges plus excise duties and value added tax. The price paid by the end user (i.e. retail price) includes all these cost elements and therefore can be defined as private marginal costs (PMC). In contrast, the externality costs or pollution costs of road fuel have to be paid by the society at large and therefore can be defined as social marginal cost (SMC). This is graphically illustrated in Graph 1 and it represents two price levels: prices based on PMC (P_1), and prices based on PMC+PSC (P_2). The latter, P_2 , implies additional costs to be considered in fixing prices for auto-diesel i.e. Rs./liter.

In this regard, the pricing of super-diesel (.5 percent of sulfur) as against normal diesel (.8 percent sulfur) is even more interesting. As at September 2005, a liter of super-diesel and normal diesel is priced at Rs.54.40 and Rs. 50.00 respectively. This price differential is mainly due to the customs duty and excise duty rather than differences in cost of production. In terms of environmental benefits, the pricing policy of super-diesel needs to be revised either to make it relatively cheaper or in par with normal diesel.

The analysis given above is mainly to demonstrate the significance of environmental considerations in auto-fuel pricing. Policy makers need to take into account both social and environmental considerations in designing pricing policies for auto-fuel. Given the inelastic nature of auto-fuel demand (i.e. -.081 for diesel), significant price increases need to be introduced in order to realize significant reductions in auto-diesel consumption. Such reductions on the other hand may lead to loss of social welfare due to its impact on cost of passenger and goods transport. The need for considering environmental damage in fixing prices for auto-diesel however, is well justified in the case of Sri Lanka.

Summary and conclusions

In spite of pro-market policy reforms of post-1977 period, the supply of auto-fuel has until recently been tightly controlled by the CPC, a state-controlled monopoly. As one of the key institutions in the semi-government sector, the CPC is expected to make revenue contributions to the government in addition to promoting social welfare. In the area of auto-fuel pricing especially, the policy advocated by the government until recently has been more influenced by revenue generation and welfare considerations rather than market fundamentals such as fluctuations in international oil prices and depreciation of the Sri Lankan Rupee. The government's discriminatory pricing policy against petrol and fiscal bias towards diesel-powered vehicles led to high growth of auto-diesel consumption. As a result, the government had to share a large subsidy obligation causing serious budgetary constraints and an unjustified burden on low income earners of the

society. Similar to many other policy reforms in Sri Lanka, the implementation of new pricing policy on auto-fuel has been rather disappointing. In 2003, for example, formula based price adjustment was done only on 6 occasions as against a price adjustment system to be implemented on monthly basis.

The damage costs associated with auto-diesel consumption is yet another factor needs to be taken into account in fixing prices for auto-fuel. Given the 'public good' character of clean air and oligopolistic structure of petroleum industry, it is very unlikely that market forces would function efficiently. Hence, there is a need for state intervention to minimize externality costs associated with auto fuel consumption. In addition to auto-fuel pricing, state intervention is also needed in other policy arenas such as vehicle inspection and maintenance, road user costs, vehicle imports and auto-fuel quality. As discussed in the main body of the analysis, auto-fuel pricing must balance a number of conflicting objectives such as revenue rising, consumer welfare and externality costs.

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Appendix 1: Changes to the Customs Duty and Tax Structure on Import of Fuel Products

		1983	1986	1993	1999	2000
	Customs Duty on CIF %	5	45	35	30	0
Crude Oil	NSL on CIF %	0	0	3	4.5	5.5
	Excise Duty on CIF %	0	0	0	0	0
	Customs Duty on CIF %	5	45	35	30	25
Petrol	NSL on CIF %	0	0	3	4.5	5.5
	Excise Duty on CIF %	0	0	Rs.1.00 (per liter)	50	45
	Customs Duty on CIF %	5	45	35	30	25
Diesel	NSL on CIF %	0	0	3	4.5	5.5
	Excise Duty on CIF %	0	0	0	15	15

Source: Sri Lanka Customs

Appendix 2: Changes to the Import Duty and Tax Structure on Import of Fuel Products

		31.1.2002	2003
	Customs Duty on CIF %	0	0
Crude Oil	NSL on CIF %	6.5	0
	Excise Duty Rs. Per liter	0	0
	Customs Duty on CIF %	0	0
Petrol	NSL on CIF %	6.5	3 (VAT)
	Excise Duty Rs. Per liter	24	21
	Customs Duty on CIF %	0	0
Diesel	NSL on CIF %	6.5	1 (VAT)
	Excise Duty Rs. Per liter	4	3

Source: Sri Lanka Customs