Energy Efficiency in the Transport Sector of Sri Lanka

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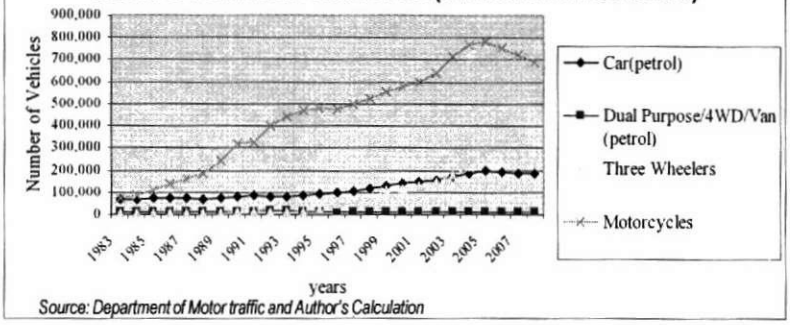
1. Introduction

Sri Lanka has become a middle-income country with per capita income of US$ 1,650 in 2008 (Central Bank of Sri Lanka, 2008). This has contributed to increase vehicle ownership and travel. There are now (as at March, 2008) 2,047,602 active vehicle fleet out of which 1,046,840 are motor cycles (two wheelers) and 368,924 of tricycles (three wheelers). It is estimated that 16 billion vehicle Kms have run during the year 2007 producing 94 billion passenger Kms and 16 billion tonne Kms which includes good transported by the railways. All travelling is done using fossil fuel, namely *gasoline and diesel*. The total consumption of fossil fuel by the transport sector amounts to 523 million Litres of petrol and 1,840,000 million Litres of diesel (Ceylon Petroleum Corporation, 2008; Lanka Indian Oil Company, 2008; Ministry of Transport, 2008; Sri Lanka Railways, 2008). The energy efficiency in the transport sector means the number of vehicle kilometres produced by a vehicle using energy (namely petrol and diesel), e.g. Number of Km per Litre. Further, it qualifies with the value addition of passenger kilometres and freight ton kilometres. The fuel efficiency depends on the characteristics of the vehicle fleet, road or track condition, driving behaviour, traffic volume, occupancy rate or load factor and pedestrian behaviour.

2. Characteristics of Road Vehicle Fleet and Railway Rolling Stocks

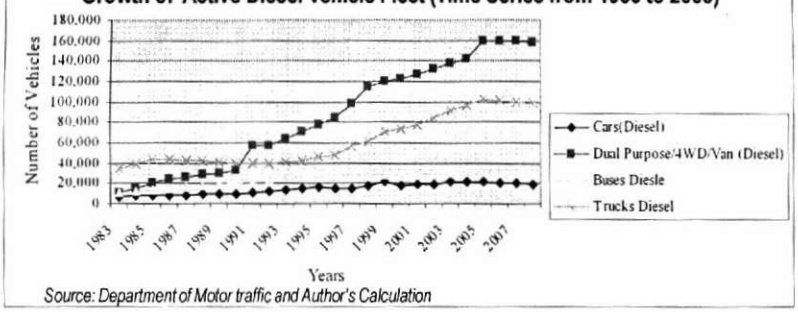
The vehicle category which showed the highest average annual growth during the last twenty five years was three wheeler which is nearly 22%. This is followed by 12% annual growth of dual-purpose vehicles, and motorcycles. The average annual growth of the total motorised vehicle fleet is 9% during the 25-year period (Department of Motor Traffic, 2008). It should be noted that the rapid increase of motor cycles and three wheelers has slowed down since 2006 as demand shifted to petrol motor cars (especially for smaller Indian cars) as shown in Figure 1. The per capita income has now reached US$ 1,640 which crossed the US$1,500 margin in 2006 (Central Bank of Sri Lanka, Monthly Bulletin, 2008). It should be also noted that the highest growth of diesel vehicle fleet is in dual-purpose vehicles which include vans and pickups trucks since 1989 (Figure 2) due to relatively low import tax, and low price of diesel compared to petrol price.

Figure 1
Growth of Petrol Active Vehicle Fleet (Time Series of 1983 to 2008)



Source: Department of Motor traffic and Author's Calculation

Figure 2
Growth of Active Diesel Vehicle Fleet (Time Series from 1983 to 2008)



Source: Department of Motor traffic and Author's Calculation

The average age of the vehicle fleet also gives an indication on the fuel efficiency which also varies with vehicle category. Table 1 shows the active vehicle fleet and its growth and Table 2 shows the average age of different vehicle categories as at July 2008. Total active vehicle fleet has reached 2.1 million in 2008 (Please note that all registered vehicles in the country is called the Vehicle Population and now it has reached 3 million).

Table 1
Active vehicle population in Sri Lanka from 1983 to 2008

Year	Cars (Petrol)	Dual Purpose/4 WD/Vans (Petrol)	Three Wheelers (Petrol)	Cars (Diesel)	Dual Purpose/4 WD/Vans Diesel	Buses (Diesel)	Trucks (Diesel)	Motorcy-cles (Petrol)	TOTAL
1983	64,947	11,620	3,290	6,546	11,036	10,693	34,761	74,769	217,862
1984	67,717	12,531	3,830	7,537	14,910	11,702	39,131	88,973	246,331
1985	72,000	13,000	4,071	8,037	20,000	13,304	43,400	108,500	282,312
1986	72,745	14,089	4,716	8,286	24,551	15,467	43,169	134,008	317,030
1987	73,977	14,565	5,982	8,699	26,213	16,903	42,585	159,029	347,954
1988	69,677	14,795	7,253	8,904	28,472	18,240	41,624	182,095	371,059
1989	72,452	14,865	8,019	9,482	29,940	19,211	40,721	243,328	438,017
1990	79,760	15,056	9,365	9,608	33,295	20,571	40,210	320,452	528,317
1991	84,943	15,241	10,679	10,522	56,630	22,360	39,740	325,099	565,214
1992	80,574	17,083	12,882	12,853	57,677	23,379	39,308	403,197	646,953
1993	78,694	16,576	13,532	13,952	63,965	25,243	40,974	445,035	697,972
1994	83,509	16,275	14,920	15,454	70,539	27,429	42,749	468,475	738,351
1995	92,802	14,089	24,905	15,715	78,155	27,290	46,332	480,395	779,683
1996	101,355	12,995	48,497	14,947	84,269	27,213	48,050	476,758	814,084
1997	106,747	12,013	59,119	15,267	98,472	29,021	57,793	499,208	877,641
1998	117,848	11,083	75,666	17,805	114,764	28,986	61,872	526,321	954,345
1999	129,607	10,220	108,430	21,568	119,800	28,818	70,282	553,028	1,041,753
2000	142,661	9,418	120,086	18,267	122,614	28,501	73,341	576,424	1,091,313
2001	149,052	10,012	128,679	18,423	126,665	29,021	78,233	599,015	1,139,101
2002	155,478	11,123	147,692	19,505	131,735	28,956	84,757	641,797	1,221,043
2003	170,040	14,490	181,774	21,437	138,116	30,007	91,197	715,838	1,362,898
2004	181,888	14,288	217,112	21,696	141,769	30,973	97,360	773,189	1,478,275
2005	194,429	14,560	286,453	21,089	159,430	31,803	102,340	784,120	1,595,224
2006	217,472	17,703	331,133	21,695	159,879	34,304	11,190	907,141	1,808,017
2007	234,368	20,306	350,689	21,097	161,042	36,024	132,466	1,051,839	2,007,831
2008	250,926	22,852	368,924	20,552	167,329	35,640	134,539	1,046,840	2,047,602

4WD – 4-wheeel drive.

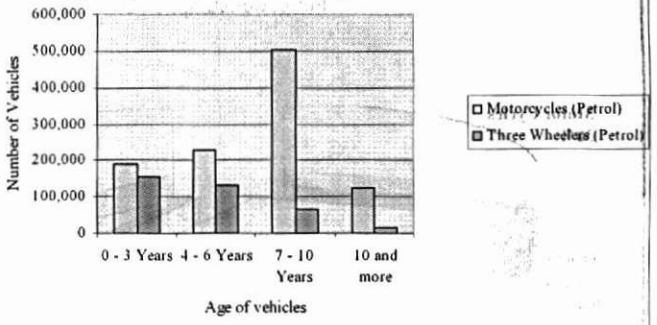
Source: Dept. of Motor Traffic, University of Moratuwa and Author's Calculation.

Table 2
Age Distribution of the Vehicle Fleet as at July, 2008

Vehicle Category/ Age	0 - 3	4 - 6	7 - 10	10 +	Total
Cars (Petrol)	97,861	80,296	52,694	20,074	250,926
Dual Purpose/4WD/Vans (Petrol)	4,113	5,484	8,227	5,027	22,852
Three Wheelers (Petrol)	154,948	132,813	66,406	14,757	368,924
Cars (Diesel)	4,932	4,521	8,426	2,672	20,552
Dual Purpose/4WD/Vans Diesel	26,773	43,506	65,258	31,793	167,329
Buses (Diesel)	8,554	9,979	11,761	5,346	35,640
Trucks (Diesel)	22,872	29,599	34,980	47,089	134,539
Motorcycles (Petrol)	188,431	230,305	502,483	125,621	1,046,840

Source: Department Motor Traffic and Fleet Survey, 2008

Figure 4
Age Distribution of the Motorcycles and Three Wheelers



A higher percentage of the petrol car fleet has an age less than six years as during last two years, special duty reduction program offered to government servants to import strictly the brand new vehicles and new smaller car fleet came from India as shown in Figure 3. It is notably demonstrated that diesel dual-purpose vehicle fleet has a high percentage of more than six years old as the used old vehicles imported have been used to make vehicles using the imported old bodies and parts to avoid all exercise duties and to get the advantage of low tax band for such vehicles. The truck fleet also records a mean value of 9.5 years age as permission was granted to import trucks up to 5 years and even up to 7 years during 2005 and 2006. The bus fleet has a number of mid-aged buses because 2,400 new buses were acquired by Sri Lanka Transport Board and the private sector to meet the new regulations. However, notably fuel efficiency has not been a criterion for the private sector bus fleet acquisition.

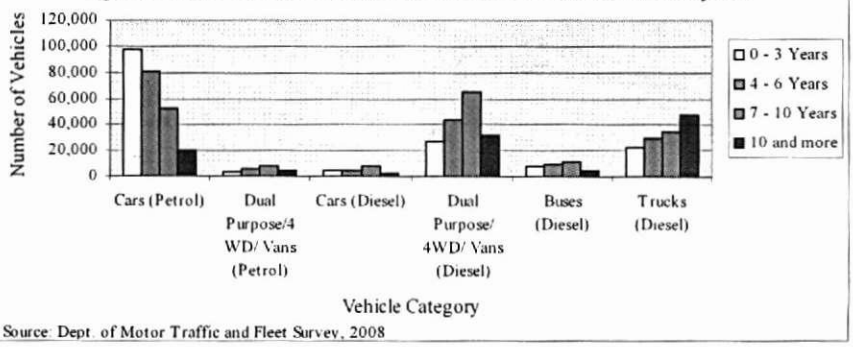
It should be noted that the Sri Lankan Railways has a very old fleet with a mean age of 29 years; of the total fleet of 132 engines, 75 are more than 25 years old (Table 3). The fuel efficiency of these engines has a mean value of 0.3 km per Litre with a minimum of 0.14 and a maximum of 0.313 as shown in Table 3.

Table 3
Age distribution and fuel efficiency of railway rolling stocks as at October, 2008

Age	Number of Engines	Fuel Efficiency Diesel Litre per Km
00 – 07	03	2.9
08 – 15	37	3.4
16 – 25	17	2.3
26 – 35	38	3.13
36 +	37	1.4

Source: Dept. of Railways.

Figure 3
Age Distribution of Vehicles other than Three Wheelers and Motorcycles



Source: Dept. of Motor Traffic and Fleet Survey, 2008

The petrol motorcycles and three wheelers have a lower life span, but there is a considerable percentage of motor cycles with two-stroke technology of more than seven years old (see Figure 4). Most of the three wheelers are less than six years old, and approximately 84% are with two-stroke technology which is low fuel efficient compared to four-stroke three wheelers. However, importation of two-stroke three wheelers has been banned from January, 2008. Details of age distribution of the active vehicle fleet are shown in Table 2.

3. Fuel Consumption by the Transport Sector

Total fuel consumption of the transport sector in 2007 was 523 million Litres of petrol and 1,460 million Litres of diesel (Ceylon Petroleum Corporation, 2008; Lanka Indian Oil Company, 2008; Ministry of Transport, 2008; Sri Lanka Railways, 2008). This shows that diesel consumption is three fold of petrol consumption in the country. Motor cars, three wheelers and motor cycles in total have consumed 94.5% of the total petrol consumption as shown in Figure 5. It should be noted that railways consumed only 30 million Litres of diesel which is only 1.7% of the total diesel consumption in the transport sector as shown in Figure 6. The average fuel efficiency of the petrol cars is 7.6 km per Litre, for three wheelers it is 17.6 km per Litre and for motor cycles 21.5 km per Litre as shown in Annex-1. It should be noted that diesel dual-purpose vans and 4-wheel vehicles have only 4.1 km per Litre efficiency because of the age of the fleet and its poorly-maintenance. The research findings of fuel efficiency of vehicles are shown in Table 4 (as at July, 2008)[1].

Table 4
Fuel efficiencies of different categories of vehicles in Sri Lanka

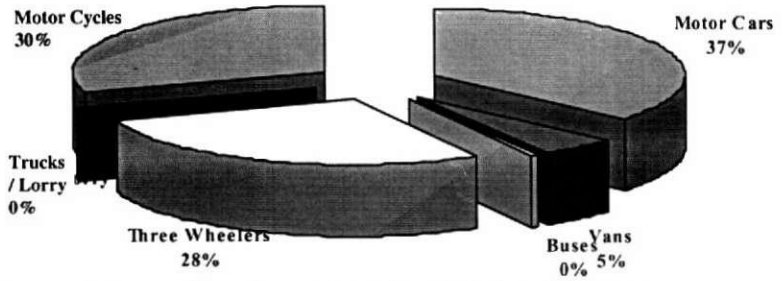
Vehicle category	Fuel efficiency (km/ Litre)
Cars (Petrol)	7.6
Cars (Diesel)	5.7
Vans/ Dual Purpose vans / 4WD (Diesel)	4.1
Buses (Diesel)	3.5
Trucks/ Lorry (Diesel)	4.2
Three Wheelers (Petrol)	17.0
Motor Cycles (Petrol)	21.6
Railway	0.33

Source: Transport survey, 2008.

All these vehicles produce passenger kilometres or freight tonne kilometres as value addition to the economy. The performance of vehicles lies not only on its fuel efficiency, but also on number passenger or freight tonne kilometres produced by them.

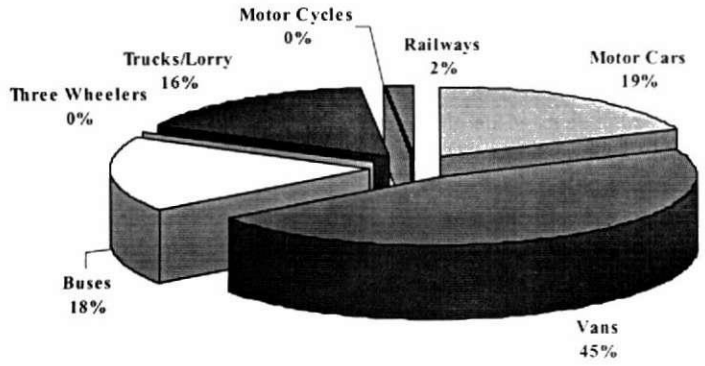
Transport sector's passenger market share in Sri Lanka is shown in Figure 7. This indicates that 63% passenger market is served by buses and 6% by the railways, accounting for only 19.7% of total diesel consumption in the transport sector. This means 181 passenger kilometres are produced by one Litre of diesel against 12.3 passenger kilometres by diesel vans/dual-purpose and 4-wheel drive vehicles and 11.4 by diesel cars. The public transport

Figure 5
Petrol Consumption 2007



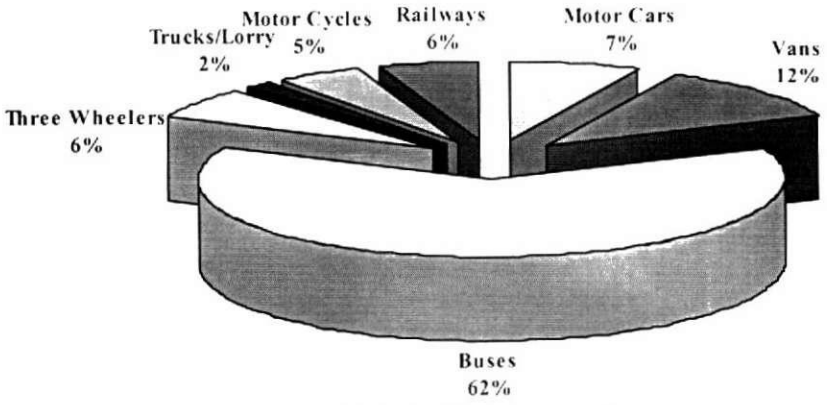
Source: Ceylon petroleum Cooperation and Lanka Indian Oil company

Figure 6
Diesel Consumption - 2007



Source: Ceylon petroleum Cooperation and Lanka Indian Oil company

Figure 7
Distribution of Passenger Market



Source: University of Moratuwa and Author's Calculation

Table 5
Active vehicle fleet, fuel consumption and travel kilo metres, 2007

Vehicle Category	Fleet	Fuel consumption Litres	Annual Vehicle Km's
Car (Petrol)	234,368	194,910,000	1,489,892,040
Car (diesel)	21,097	344,660,000	1,964,562,000
Three Wheelers (petrol)	350,689	149,520,000	2,637,532,800
Vans (diesel)	161,042	852,580,000	3,495,578,000
Buses (diesel)	36,024	326,520,000	1,142,820,000

Source: Dept. of Motor Traffic and Author's calculation.

with high occupancy vehicles are the most economically productive mode of transport which saves energy too. Table 5 shows the total fuel consumed by different categories of vehicles with number of kilometres produced by them. This indicates the need of clear vision for changing the vehicle fleet and use towards fuel efficient path without disturbing the economic development and hampering people's travel needs.

4. Analysis of Fuel Efficiency in the Transport Sector

In a market economy, demand for a fuel efficient vehicles lies with initial ownership price and owner's private operational cost excluding public costs (external costs). Therefore, the purchased price of vehicle and fuel prices are key factors of determining elasticity. An analysis of world market prices of petrol and liquefied petroleum gas (LPG) during the past four years were highly correlated (correlation coefficient was 0.88).

4.1 Evaluation of market response on ownership price

In this section we examine the influence of prices on decision making of road users. The first set of questions are concerned with choices made at the time of purchase of vehicle (and particularly on whether to buy a diesel or gasoline-powered vehicle) is likely to be a function of consumer's expectations about the cost of operation (a matter, in turn, of expectations about the future price of different fuels at the pump), and initial cost. The second set of questions is concerned with the aggregate response of all road users to changes in fuel prices at the pump. Rates of taxation play an equally a similar role as it is included in the consumer price which influences shaping demand. The world oil prices are reflected in the CIF (cost, insurance and freight) prices, and as noted, tax rates on gasoline and diesel fuel are not only very different, but in the case of petrol, taxes far exceed the total CIF cost[2]. Similarly, rates of customs and excise duties on vehicle imports show wide variations across different vehicle types, and has made more complex by provision for exemptions and concessions to certain types of owners (which are frequently changed).[3]

The demand for vehicles in Sri Lanka has been studied by Chandrasiri.[4] Vehicles are not manufactured in Sri Lanka,[5] so the entire demand is met by imports, of which only 25% were new vehicles. Today, the typical passenger car imported is reconditioned Japanese vehicles which are 3-3.5 years old. Unfortunately, as noted by Chandrasiri (1999), the available data are of poor quality, because such records are kept by Sri Lanka Customs and do not have the requisite details on engine capacity, year of manufacture, etc.

In Figure 8, we show the average nominal price, ex-customs,[6] for the four main types of passenger vehicles, expressed in US$. Figure 9 shows the corresponding data in contrast in Rupee value in 1982. Several points are worth noting:

- by expressing prices in US$, most of the price variations reflect changes in taxation.[7]
- the sharp decline in importation in 1978 reflects the lowering of import duties at the time of liberalisation of the economy.

The recent (since 1995) increase in the price of diesel vehicles – a reflection of the imposition of so-called "luxury taxes" and "exercise duty" – is largely cosmetic, and this has resulted in the number of diesel passenger cars actually sold quite small (most of the growth being in "dual-purpose" vehicles).[8] There is a lower tax threshold for the dual purpose vehicles. The significant proportion of those diesel cars that are imported have benefited from special permits and exemptions, especially in 2007.

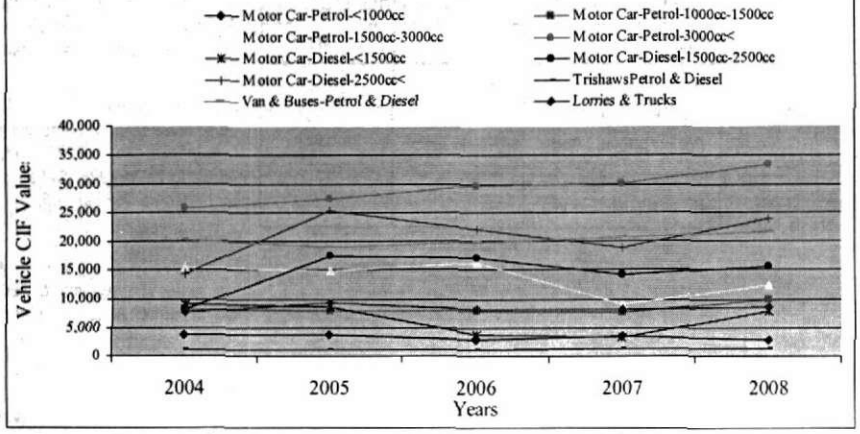
purchase is seen to be double that of the gasoline-powered car.

Several estimates of price elasticities of aggregate transportation fuel demand in Sri Lanka are available in the literature (Table 7)[9]. However, many of the earlier estimates are limited to 1970-1985 period and do not properly capture the major changes in road transport consequent to liberalisation of the economy in 1977. The estimates by Meier *et al,* (1997) do include the early years of liberalisation, but their time series is still relatively short and extends only to 1991.[10]

5. Economic Implications

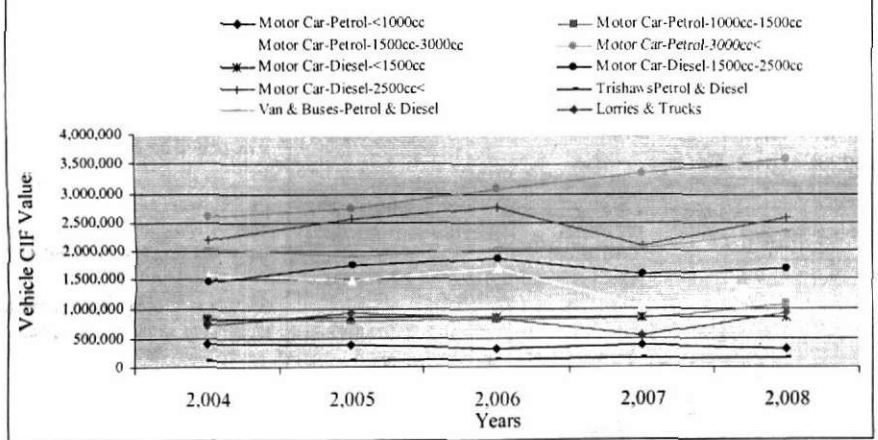
Total energy usage in the transport sector is limited to fossil fuel which is imported from different markets. The total expenditure for the fossil fuel imported was Rs.3.2 billion in 2007 (Ministry of Finance and Planning, 2007). Therefore, increase of travel demand has a direct impact on the importation of fossil fuel in terms of quantity and expenditure. The value addition in the transport sector depends on the passenger km and freight ton km. However, impact lies with direct expenditure and indirect public cost such as traffic congestion, air pollution and other environmental impacts.

Figure 8 - Vehicle CIF Value (US$:)variation from year 2004-2008



Source: Estimates based on data from Sri Lanka Customs (2005).

Figure 9 - Vehicle CIF Value (SLRs:) variation from year 2004-2008



Source: Sri Lanka Customs and calculated by the author in 1982 constant Rupees.

Table 6
Comparison of diesel and petrol vehicle price for the Toyota model RAV4

Cost in Rs	Gasoline	Diesel
Costs at purchase		
CIF	2,600,000	2,950,000
Import duty	728,000	826,000
PAL	78,000	88,500
SUR	390,000	442,500
Excise Duty	1,040,000	3,540,000
VAT	967,200	1,569,400
Road Dev. Levy	290,160	627,600
SRL	39,000	44,250
Total tax	3,532,360	7,138,250
Total CIF+tax	6,132,360	10,088,250
Tax[as% of total]	58%	71%
Annual taxes		
Registration	3,500	6,500
Luxury tax		50,000(1)
Annual fuel cost		
km/year	12,000	16,000
km/Litre	10	8
Litres/year	1,200	2,000
price/Litre	157.00	110.00
Annual fuel cost	188,400	220,000

Note: Imported as reconditioned, 3.5-year old vehicles
Luxury tax declines by 10,000 Rs/year, reaching zero in the 6-th year
figures are tabulated for taxes and typical prices as of June, 2008.
VAT – Value added tax
PAL- Port & Aviation Levy
SUR – Surcharge
SRL – social Security Levy

The economic and financial costs per kilometre of the electric-powered vehicles, vehicles run by LPG and compressed natural gas (CNG), and hybrid vehicles are shown in Tables 8, 9 and 10.

This concludes that pricing structure (Financial) for motor vehicle ownership does not consider the fuel efficiency as a key factor for the customers to make decisions for fuel type of the vehicle. This is the reason for low fuel efficient fleet to be prevalent in the country up to 2008. It is clear that market condition of Sri Lanka is responsive to the price and running costs when we consider elasticity.

6. Conclusion

The findings of the above analysis with the support of empirical studies indicate that ownership cost and operational cost of vehicles should be managed through a market tool to shift the vehicle fleet to more fuel efficient and productive one. Finally, the need for high occupancy public transport system is justified by the market conditions.

In Table 6, we show a comparison of the taxes levied on diesel and petrol cars, using the same Toyota model differing only by type of engine. The tax burden for the diesel vehicle at the time of

Table 7
Estimates of ownership - price elasticity

	Time series	Petrol (gasoline)	Diesel
Sri Lanka			
deSilva, 1989 (1)	1970-1985	-0.55	-1.21
Samaraweera, 1989 (2)	1970-1985	-0.387	-0.26
Ranasinghe, 1989 (3)	1970-1985	-0.508	-0.034
Meier *et al.* (1993)	1973-1991	-1.14(long-run) -0.334(short-run)	
McRae(1994)	1973-1987	-0.337	
Jayaweera (1999) (8)		-0.163(long run) -0.115(short run)	-0.339(long run) -0.154(short run)
Other countries			
Philippines (6)	1973-1987	-.391	
Thailand (6)	1973-1987	-.304	
Malaysia (6)	1973-1987	-.125	
S.Korea (6)	1973-1987	-.496	
S. Korea (5)	1973-1997	-0.866 (long-run)(*) -0.385 (short-run)(*)	
Indonesia (6)	1973-1987	-.197	
India (6)	1973-1987	-.321	
Taiwan (6)	1973-1987	+0.024	
Taiwan (7)	1954-1985	-1.362(long-run) -0.245(short run)	
Taiwan (5)	1973-1992	-0.519(long-run)* -0.124 (short-run)*	

(*) demand for gasoline and diesel taken together [see text discussion below]

(1) A. P. D. S. de Silva, *Impact of energy price changes on transport*, in E. N. Wijeratne, ed., Energy pricing options in Sri Lanka, ILO, 1989.

(2) C. P. Samaraweera, *Determinants of petroleum demand in Sri Lanka*, in E. N. Wijeratne, *op.cit.*

(3) Ranasinghe, A. P., *Impact of fuel price changes on Transport*, in E. N. Wijeratne, ed., op.cit.

(5) S. Banaszak, S., U. Chakravorty and P. Leung, *Demand for Ground transportation Fuel and Pricing Policy in Aisan Tigers: A Comparative Study of Korea and Taiwan*, Energy Journal, 20:2, p.145-165, 1999.

(6) R. McRae, *Gasoline demand in developing Asian countries*, Energy Journal, 15:1,143, 1994.

(7) C.Garbacz, *Gasoline, diesel and motor fuel demand in Taiwan*, Energy Journal, 10:2,143, 1989.

(8) Don S Jayaweera, *Effective steps towards traffic calming in developing countries: A case study for Metropolitan Region of Colombo in Sri Lanka*, Ph.D. Thesis, MIT, Nov.1999.

Table 8
Cost per km by fuel type: Cars

Fuel Type	Economic Cost	Financial Cost[1]
Petrol	25.54	61.47
Liquid Petroleum Gas	29.38	65.31
Compress Natural Gas	24.45	58.74
Electric Powered	18.24	54.17
Hybrid (Petrol + Electric)	20.57	44.67

[1] Financial costs were calculated assuming all current levels of taxes on petrol were applied for all fuel type vehicles.

Source: Vehicle Operating Cost Study, Third Road Project, ADB and Estimated Cost based on Toyota hybrid vehicles, 2007.

Table 9
Cost per km by fuel type: Vans/ Dual Purpose

Fuel Type	Economic Cost	Financial Cost[1]
Diesel	27.95	34.20
Liquid Petroleum Gas	31.12	36.20
Compress Natural Gas	21.07	31.32
Electric Powered	19.02	28.12
Hybrid (Petrol + Electric)	-	-

[1] Financial costs were calculated assuming all current levels of taxes on petrol were applied for all fuel type vehicles

Source: Vehicle Operating Cost Study, Third Road Project, ADB and DOT, Nepal, Katmandu

Table 10
Cost per km by fuel type: Three Wheelers

Fuel Type	Economic Cost	Financial Cost[1]
Petrol	11.26	15.31
Liquid Petroleum Gas[2]	09.32	15.37
Compress Natural Gas	08.36[3]	13.54
Electric Powered	07.03	12.32
Hybrid (Petrol + Electric)	-	-

[1] Financial costs were calculated assuming all current levels of taxes on petrol were applied for all fuel type vehicles.
[2] Assumed that original three wheelers is manufactured for LPG.
[3] This number does not include the cost of infrastructure for storage and distribution of CNG. Prices are as at Indian market (one Kg.=Ind. Rs. 18.9).

Source: Bajaj Motor Co. India – (Price of original LPG three wheeler is US$ 1,625 = SLRs. 175,500/=

ANNEX - 1

Fuel Consumption by Vehicle Type 2007 534,000,000

Fisheries and Others	2%	10,680,000 Liters
Transport	98%	523,320,000 Liters
	534,000,000	

Petrol

Vehicle Type	Consumption	in liters	Vehicle Km	Passenger Km	
Motor Cars	36.5%	194,910,000	1,489,892,040	2,979,784,080	7.6
Vans	5.0%	26,700,000	136,063,200	571,465,440	5.1
Buses	0.5%	2,670,000	10,989,720	571,465,440	4.1
Three Wheelers	28.0%	149,520,000	2,637,532,800	5,802,572,160	17.6
Trucks/Lorry	0.3%	1,602,000	8,163,792	10,612,930	5.1
Motor Cycles	30.0%	160,200,000	3,453,912,000	4,490,085,600	21.6
Total	**100.30%**	**535,602,000**	**7,736,553,552**	**14,425,985,650**	

Passenger Market Shares

Motor Cars	7.3%
Vans	11.6%
Buses	63.0%
Three Wheelers	6.1%
Trucks/Lorry	1.7%
Motor Cycles	4.7%
Railways	5.6%
Total	**100.0%**

		1,814,000,000	Liters	2,180,000,000
Power Sector(incl	29%	632,200,000		
Transport Sector	67%	1,460,600,000		
Agriculuture & Industries		4%	87,200,000	265.7729833
Industries and	100%			

Diesel

Vehicle Type	Consumption	in Vehicle Km		Passenger Km
Motor Cars	19%	344,660,000	1,964,562,000	3,929,124,000
Vans	47%	852,580,000	3,495,578,000	10,486,734,000
Buses	18%	326,520,000	1,142,820,000	59,426,640,000
Three Wheelers	0%	0	0	0
Trucks/Lorry	16%	290,240,000	1,219,008,000	1,584,710,400
Motor Cycles	0%	0	0	0
Railways	1.7%	30,475,200	10,056,816	5,370,339,744
Total	**100.0%**	**1,814,000,000**	**7,821,968,000**	**80,797,548,144**

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Footnotes

[1] *These numbers obtained through a sample survey representing the running fleet in 2008*

[2] *Taking Market level in June, 2008*

[3] *These are noted by Chandrasiri (1999) pg.10. For example, special privileges are extended to State Corporations such as the Sri Lanka Transport Board (SLTB), formerly the State Monopoly. Specia*

l permit schemes for public servants and politicians were terminated in 1994, then reintroduced in 1998, and again rescinded in October 2005.

[4] *Ibid, p. 8-10.*

[5] *However, there are four companies (Micro, Dimo, LATEC, Ceymo and Ashok Leyland) which assemble*

motor cars, jeeps, trucks and buses in Sri Lanka. The assembly operation involves fixing of body kits and chassis imported from six major sources: Korea, German, U.K., Japan, India and China.

[6] *i.e. CIF plus all duties and taxes, but excluding dealer margins.*

[7] *Nominal CIF prices in US$ would of course have increased over this period, so the general trend would expected to be upward.*

[8] *In June, 2008, we estimate only some 20,552 diesel passenger cars in the fleet, as opposed to 250,995 gasoline cars, and 167.540 diesel-powered dual-purpose vehicles.*

[9] *In all cases, except where noted, the dependent variable is consumption per vehicle. We note that several US studies use consumption per driver — see, e.g., Greene (1999).*

[10] *However, this study used the so-called vehicle use lagged endogenous model, which models demand as the autoregressive function $Q_t = f(Q_{t-1}, P, Y, ...)$, and which allows separate estimation of long and short-run elasticities.* ■