EVALUATION OF ECONOMIC, FINANCIAL, SOCIAL AND ENVIRONMENT IMPACTS BY INTRODUCING A TAX CONCESSION FOR ECONOMICALLY AND ENVIRONMENTALLY EFFICIENT VEHICLES

Preamble and Definitions

Sri Lanka has reached to a middle income group countries with per capita income of US $ 2,200/= as at January 2010. The rising per capita has contributed to increase the demand for vehicle ownership and travel. There are now (as at February 2010) 2,231,326 active vehicle fleet out of which 1,224,043 are motor cycles (two wheelers) and 371,873 of tricycles (three wheelers). The detail data is shown in Annexure-I. It is estimated that 19.286 billion vehicle Km has ran during year 2009 producing 113.04 billion passenger Kms. Country is making all these travel using fossil fuel, namely gasoline and diesel. The total consumption of fossil fuel by the transport sector is amounting to 704.343 million liters of petrol and 2,113.489 million liters of diesel.[1] The Annexure-II shows the detail fuel consumption and contribution of passenger and freight transportation in the island.

Emissions of carbon monoxide (CO), hydrocarbons (HCs) and oxides of nitrogen (NOx) from mobile sources have an adverse impact on human health and the environment by contributing to the formation of photochemical smog, acid rain and elevated CO levels. Reactions of NOx and HCs with hydroxyl radicals in the presence of ultraviolet light lead to the formation of ozone (a principal component of photochemical smog) in the lower atmosphere. The majority of urban NOx emissions in the United States are from mobile sources and data from the eastern United States indicate that nearly 30 - 40% of acid rain is due to nitric acid. Carbon monoxide, like ozone and NOx, is also a respiratory irritant and has been regulated as a criteria pollutant by the United States Environmental Protection Agency (USEPA). Hydrocarbons and smoke particulates include toxic materials that are very harmful to the public health and increase mortality.

Measurement of these constituents in automobile exhaust is therefore important in urban air quality control, human health impact assessment and environment pollution assessment. Rapidly increasing vehicle population and fuel consumption, particularly diesel, high proportion of old vehicle usage in transportation and poor vehicle maintenance, absence of clean fuel and high rate of urbanization are some of the factors contributed to high air pollution levels in Sri Lanka, which are significantly higher than the recommended health standards.

Automobile exhaust is a major source of air pollution in Sri Lanka. The existing evidence has shown that the urban environment of Colombo is heavily contaminated with vehicular emissions. Various studies undertaken by regulatory agencies and researchers clearly indicate that inefficient combustion of petroleum in motor vehicles is the primary cause of growing air pollution in Colombo, which is the largest metropolitan area with nearly 52% of the vehicle population, is on the move and where 30% of the nation's human population dwells. The observed lead (Pb), total suspended particulates (TSP), sulphur dioxide (SO_2), and ozone (O_3) levels are significantly higher than the levels recommended by the World Health Organization (WHO) and the Central Environmental Authority (CEA) of Sri Lanka.

Main health effects to local community have been identified as Asthma[2], and respiratory diseases. This analysis is quantifying the health effects of the Asthma and others will approximate the numbers. All taxes collected from the vehicles at the time of customs clearance taken as government revenue in addition to the all annual fees which includes

[1] This consumption was for year 2009

[2] Study report on Macro Economics and Health Sri Lanka

registration and ownership transfer fees. It is observed that 15.96 billion Sri Lankan Rupees was collected in 2007 from the vehicles importation as follows;

I. Customs Duty;
II. Value Added Tax;
III. Social Responsibility Levies;
IV. Ports and Airport Development Levies;
V. Value Added Tax;
VI. Cess;
VII. Excise Duties;
VIII. Nation Building Tax and
IX. Road Infrastructure Development Levies

This analysis is limited to motor cars (diesel and petrol), three wheelers (petrol), and diesel powered vans, and diesel powered buses. The Table-1 shows that these are the vehicles which consume a higher percentage of fossil fuel.

Table 1 – Active Vehicle fleet, Fuel Consumption and Travel Km 2009

Vehicle Category	Fleet	Fuel consumption litres	Annual Vehicle Km's
Car (Petrol)	245,436	256,316,374	3,918,564,720
Car (Diesel)	22,539	401,513,676	2,288,909,535
Three Wheelers (Petrol)	371,563	196,626,259	7,630,671,867
Vans (Diesel)	162,080	993,340,241	4,072,694,989
Buses (Diesel)	36,110	380,428,178	1,420,265,196

Source: Dept. of motor Traffic, CPC, SLIOC and Author's Calculation

It should be noted that 84% of the petrol is used by motor cars and three wheelers. Further, 84% of the diesel is used by the motor cars, vans, and buses as shown in Figure-1 and Figure-2.

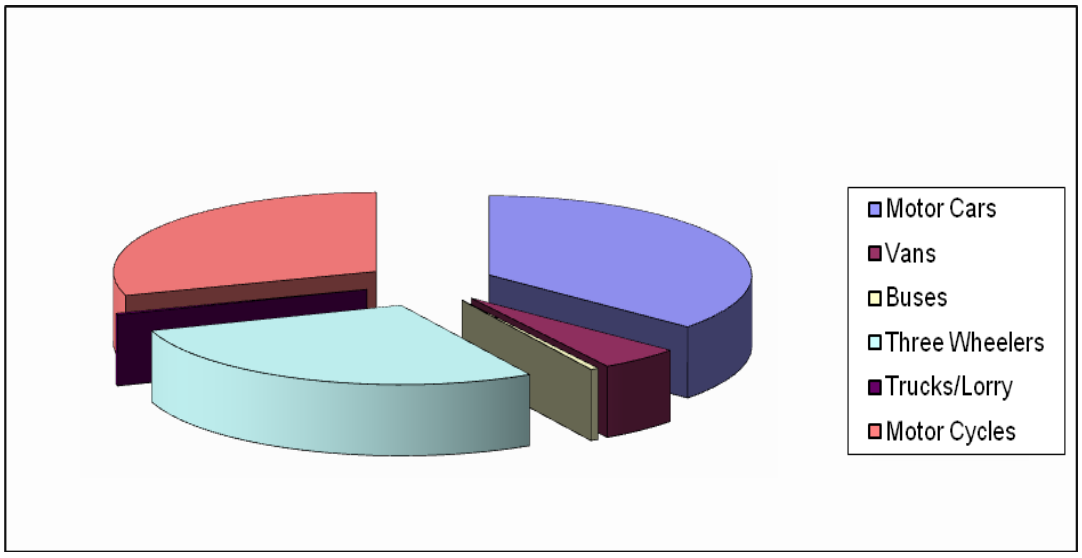


Figure1: Petrol Consumption in Year 2009

Figure-1 shows that 36.5% of the petrol has consumed by the Motor cars and 18% by the three wheelers. Figure 2 is indicating that 47% of the total diesel consumption is by the vans, 19% by the motor cars and 16% by the buses. This evaluation mostly focused to wards three wheelers, motor cars, vans considering the fact the above taxes are mainly collecting from these three categories and very small amount from the buses.

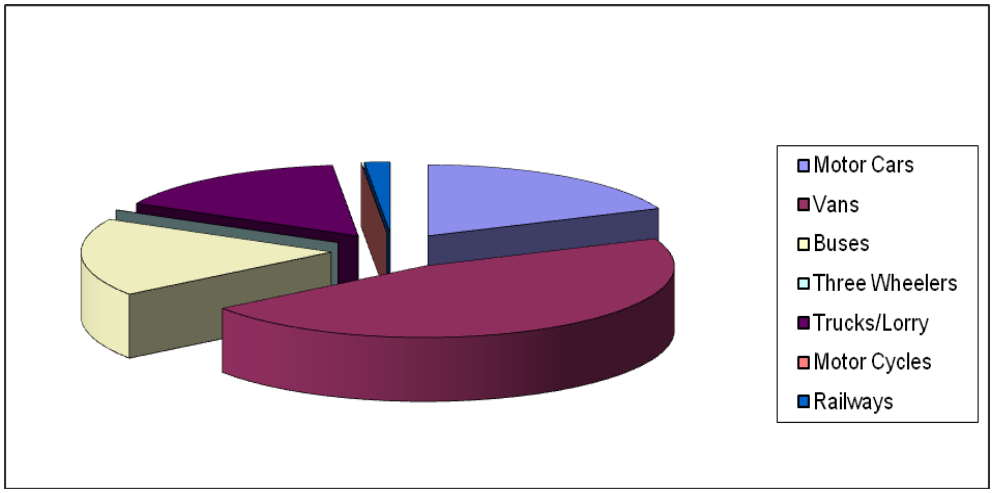


Figure 2: Diesel Consumption in Year 2007

1. Base line assessment of revenue collection from motor vehicles

Total revenue collection from the imported motor cars from January to May, 2008 amounts to SLRs. 15,029 million out of which SLRs.6,834 million is from importation of used cars and SLRs. 8,195 million from the brand new motor cars. This means that the total estimated revenue for the year 2008 from the motor cars will be SLRs. 36,070 million. Revenue has been collected from the three wheelers from January to May 2008 amounts to SLRs. 1,208 million which is estimated revenue as SLRs. 2,899 million in year 2008. The baseline (as at June, 2008) revenue collection per unit is shown in Table-2 which will be used to identify the optimal scenario through a leaner programming analysis.

Table 2 – Analysis of Tax Revenue on Importation of Vehicles –Base Case Scenario (June, 2008)

All these are on CIF Value (%)

Vehicle Category	Import Duty	Cess	PAL	SUR	Excise Duty	VAT	RADL	SRL	NBT	Total %
Car (Petrol) Brand New	28.0	11.0	5.0	4.2	143.0	24.9	17.70	1.63	9.04	244.47
Car (Petrol) Used	28.0	11.0	5.0	4.2	143.0	24.9	17.70	1.63	9.04	244.47
Car (Diesel) Brand New	28.0	11.0	5.0	4.2	307.64	34.27	27.71	5.10	13.98	436.90
Car (Diesel) Used	28.0	11.0	5.0	4.2	307.64	34.27	27.71	5.10	13.98	436.90
Van(Diesel) Brand New	28.0	11.0	5.0	4.2	208.08	29.30	21.66	3.60	10.99	321.83
Van (Diesel) Used	28.0	11.0	5.0	4.2	208.08	29.30	21.66	3.60	10.99	321.83
Three Wheelers (Petrol)	15.0	0.0	5.0	4.2	71.08	18.34	13.33	1.55	6.88	135.38

Source: Dept. of Customs and Consultant's calculation

In general, cars, vans and three wheelers pay more than 100% as tax to the government. The road user levies is also charged at the point of vehicle importation as road user tax system is primitive. The highest tax paid by the diesel motor cars and the total revenue increases if the brand new vehicles are imported because of the CIF value of lower tax collection is also lower. It was found that used car importation is diminishing government revenue and increase health and environmental costs.

2.1 Base Case Scenario Evaluation of Tax Collection and Economic, Environmental and Social Costs

Current global petroleum market prices (as at February 2010) are shown in Table-3. It shows that prices of Petroleum products are in the similar range. There is a close correlation between gasoline, diesel and LPG price increase in the global market.

Table -3 – Price of Petroleum product use by the Transport Sector (In current SLRs.)

Petroleum Product	Price (CIF)
Petrol	96.50
Diesel	98.78
LPG	64.98
Gasoline(Eco)	96.50
Auto Gas	64.98
Diesel(Eco)	95.78

Source: Singapore Oil, Laugfs gas SL

There is no difference in tax threshold for vehicles based on the fuel efficiency and use of alternative fuels by the vehicle as at today. The Base Case Environmental and Economic Analysis shows in Table-4.

Table -4 – Economic and Environment Evaluation (Unit Cost) for Diesel &Petrol Vehicles

Vehicle Category	Value Addition	Cost of Vehicle CIF	Health Cost	Global Env. Cost	Fuel Cost(Eco)	Spare parts(Eco)	Total Benefit/ Cost
Car (Petrol) Brand New	3,840,000	1,600,000	5,657	20,675	1,052,727	216,000	944,941
Car (Petrol) Used	2,304,000	1,200,000	3,394	24,810	694,800	129,600	251,396
Car (Diesel) Brand New	3,072,000	1,650,000	10,560	28,223	859,335	211,200	312,682
Car (Diesel) Used	1,920,000	1,300,000	7,543	41,812	718,350	132,000	-279,705
Van (Diesel) Brand New	5,760,000	1,650,000	13,200	68,819	2,189,257	272,000	1,566,724
Van (Diesel) Used	4,032,000	1,400,000	16,800	160,578	1,787,893	190,400	476,329
Three Wheelers (Petrol)	630,000	220,000	1,650	35,868	120,625	33,250	218,607

Source: Road Development Authority, ADB, and Consultant's Calculation

2.1.1 Conversion of Petrol Driven 4 and 2 storks three-wheelers to LPG

Fuel efficiency of petrol driven and LPG driven three-wheelers indicated in terms of number of Km per litre is given below.

	LPG	Petrol
Fuel Efficiency (Km)	25	34

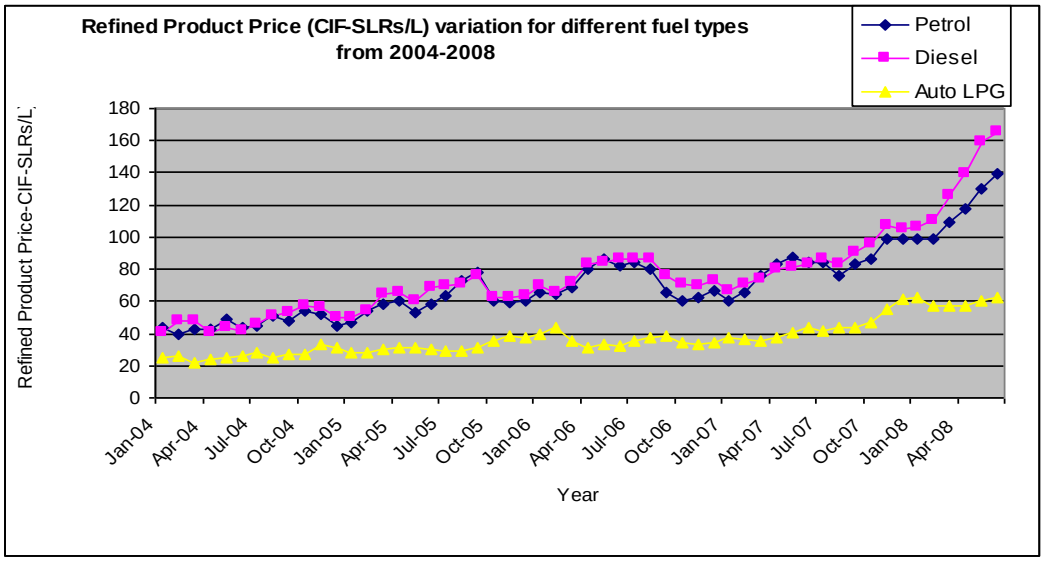
Refined product prize variation of the market from January 2004-June 2008 has been shown in Graph 3. It was found that periodic base product petrol and LPG price variables have shown a significant price variation. Graph-1: shows the correlation and the price variation for 2008 (Annexure III).

According to the statistical analysis, correlation between market value of petrol and LPG is highly significant in last 4 years.

Correlations between World Market Price of Petrol and LPG

	LPG	Petrol
Pearson Correlation	1.000	.880
Sig. (2-tailed)	.	.000
N	54	54

** Correlation is significant at the 0.01 level (2-tailed).



Graph 3: Refine Product Price (CIF-SLRs:/L) variation of market for different fuel types from Jan 2004 to June 2008

Source: Dept. of Customs and MoFP-Dept. of Fiscal Policy

Average number of kilometres run by a three-wheeler for a litre of LPG – Y
Average number of kilometres run by a three-wheeler for a litre of petrol – Z
Price of a LPG litre – A
Price of a petrol litre – B

Fuel expenses for three-wheeler–

$$\text{By LPG} = (A/Y) = \text{SLRs: } \frac{37.26}{25} = \text{SLRs: 1.49 per Km}$$

$$\text{By Petrol} = (B/Z) = \text{SLRs: } \frac{70.8}{34} = \text{SLRs: 2.08 per Km}$$

It shows that economic fuel cost of a LPG three-wheeler to run 1Km is SLRs: 1.49 (excluding all the taxes and charges) while that of a petrol driven three-wheeler is SLRs: 2.08.

According to the conversion manufacturers, conversion of a three-wheeler from Petrol to LPG costs SLRs: 30,000.00 and the lifetime is 4 year. Therefore, gas conversion fee is SLRs: 30000/= + 17% income for 4 years). Furthermore conversion cost has to be included in the operational cost, additional costs etc.

Petrol driven three-wheeler converted to LPG three- wheeler, considering 4 year lifetime will incur SLRs:2.34 per Km.

$$= \frac{\text{[SLRs: 30,000 + (17\% interest for 4 years)]}}{4 * 7000} = \text{SLRs: } \frac{65,773.45}{4* 7000} = \text{SLRs: 2.34 per Km}$$

Note: Average Km run by a hiring three wheeler is 7000Km per annum

Therefore the running cost of LPG Converted three-wheeler = SLRs: 1.49 + SLRs: 2.34
= SLRs: 3.83 per Km

Therefore LPG converted three-wheelers cost SLRs: 3.83 per Km to run on the roads whereas petrol three-wheelers cost SLRs: 2.08 per Km.

However, health benefit receiving from LPG (for a life time) is estimated as SL Rs: 338.00 on the benefit of less emission of Hydro Carbon (HC), Carbon Dioxide (CO_2) and Particulate Matter (PM_{10}).

By Petrol = SLRs: 2.08 + SLRs: $\frac{338.00}{4^* 7000}$ = SLRs: 2.09 per Km

Accordingly, the running cost of an LPG converted three-wheeler is SLRs 3.83 per Km while that of petrol driven three-wheeler is SLRs 2.09 per Km. Therefore, the difference is SLRs (-) 1.74 per Km. Hence, to run 28,000 Km (average distance travelled by a three-wheeler for 4 years= 7000 Km * 4years) the LPG converted three-wheeler costs an additional amount of SLRs (-) 1.74* 28,000 = SLRs: 48,720.00.

2. Evaluation of market response on ownership price

In this section we examine the influence of prices on decisions of road users. The first set of questions concern choices made at the time of vehicle purchase (and particularly on whether to buy a diesel or gasoline powered vehicle) 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 first cost. The second set of questions concerns the aggregate response of all road users to changes in fuel prices at the pump. Rates of taxation play as much a role in shaping these decisions as world oil prices and CIF prices of automobiles: as noted, tax rates on gasoline and diesel fuel are not only very different, but in the case of petrol, tax far exceeds the CIF cost[3]. Similarly, rates of customs and excise duty on vehicle imports show wide variations across different vehicle types, made more complex by provisions for exemptions and concessions to certain types of owners (which are frequently changed).[4]

The demand for vehicles in Sri Lanka has been studied by Chandrasiri.[5] Vehicles are not manufactured in Sri Lanka,[6] 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 detail on engine capacity, year of manufacture, etc.

In Figure 4, we show the average nominal price, ex-customs,[7] for the four main types of passenger vehicle, expressed in US$. Figure 5 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 variation reflects changes in taxation.[8]

[3] Taking Market level in June, 2008

[4] 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. Special permit schemes for public servants and politicians were terminated in 1994, then reintroduced in 1998, and again rescinded in March 2001.

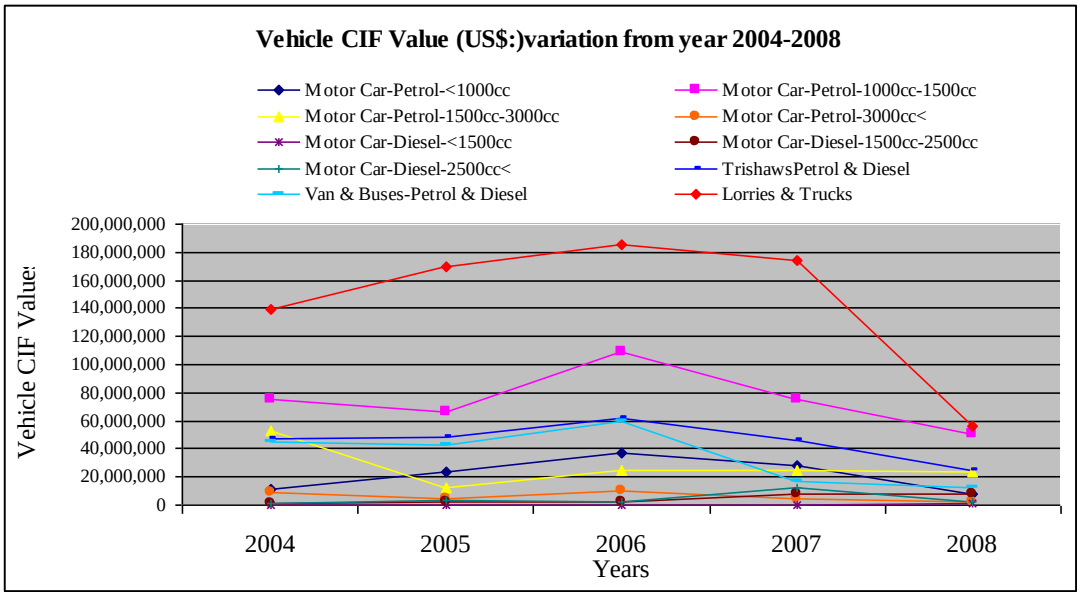
[5] *Ibid*, p. 8-10.

[6] However, there are four companies (Micro, Dimo, Latec, Ceymo and Ashok Leyland) which assemble motor cars, jeeps, trucks and busses in Sri Lanka. The assembly operation involves fixing of body kits and chassis imported from four major sources: Korea, German, U.K., Japan, India and China.

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

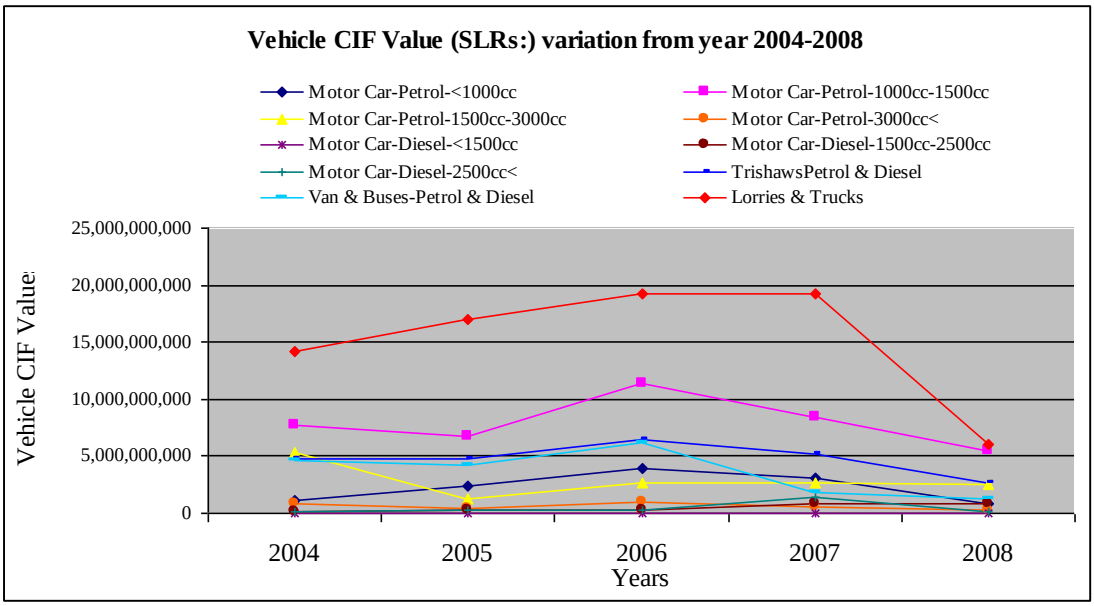
- the sharp decline in of 1978 reflects the lowering of import duties at the time of liberalization of the economy.

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, for the number of diesel passenger cars actually sold is quite small (most of the growth being in "dual-purpose" vehicles),[9] and a significant proportion of those that are imported have benefited from special permits and exemptions, specially 2007.



Graph 4: Vehicle CIF Value (US$) variation from year 2004-2008

Source: Estimates based on data from Sri Lanka customs, 2005



Graph 5:Vehicle CIF Value (SLRs) variation from year 2004-2008

Source: Writers' estimates based on Sri Lanka customs: Central Bank for Currency conversion rate

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

[9] 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.

In Table 5, 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 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 6)[10]. 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 liberalization of the economy in 1977. The estimates by Meier et al., (1997) do include the early years of liberalization, but their time series is still relatively short and extends only to 1991.[11]

Table 5: 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.

[10] 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).

[11] 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.

Table 6: Estimates of ownership - price elasticity

Country	Time Series	Petrol (Gasoline)	Diesel
Sri Lanka			
De Silva, 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) (4)	1973-1991	-1.14(long-run)	
		-0.334(short-run)	
McRae(1994) (6)	1973-1987	-0.337	
Jayaweera(1999) (8)		-0.163(long run)	-0.339(long run)
		-0.115(short run)	-0.154(short run)
Jayaweera (2008)	1982 -2007	-0.1637(long run)	-0.324(long run)
		-0.1179(short run)	-0.151(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.
(4) Meier Peter (1993) Energy Consumption
(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 motorfuel 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.

On the basis of Table-6, we are using short term price elasticity of Jayaweera (2008) to asses the market shift with optimal level of price which gives the economic, social benefits at maximum with appropriate vehicle mix.

3. Economic, financial, social and environmental benefits of electrical power, liquid petroleum, natural gas and hybrid vehicles

Base case scenario shows that the economic and financial cost of the Electric Power, LPG, CNG, and Hybrid Vehicles on the assumption that the all taxes are applicable for the vehicles without any consideration of fuel type.

Table-7: Table series of Economic and Financial cost of the Eco Friendly Vehicles by fuel type

Cost per Km by Fuel Type (Base Case Scenario) = Cars[12]

Fuel Type	Economic Cost	Financial Cost[13]
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

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

Cost per Km by Fuel Type (Base Case Scenario) = Vans/Dual Purpose[14]

Fuel Type	Economic Cost	Financial Cost
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)	-	-

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

Cost per Km by Fuel Type (Base Case Scenario) = Three Wheelers[15]

Fuel Type	Economic Cost	Financial Cost
Petrol	11.26	15.31
Liquid Petroleum Gas[16]	09.32	15.37
Compress Natural Gas	08.36[17]	13.54
Electric Powered	07.03	12.32
Hybrid (Petrol + Electric)	-	-

Source: Bajaj Motor Co. India – (Price of original LPG three wheeler is US $ 1,625 = SLRs. 175500/=

4. Identification of appropriate tax structure for vehicle mix at optimal position

[12] Financial cost calculated assuming that the all present taxes is applying for all fuel type equal to petrol vehicles

[13] Current taxes has taken to calculate the financial cost

[14] Financial cost calculated assuming that the all present taxes is applying for all fuel type equal to petrol vehicles

[15] Financial cost calculated assuming that the all present taxes is applying for all fuel type equal to petrol vehicles

[16] Assumed that original three wheelers is manufactured for LPG

[17] This number does not includes the cost of infrastructure for storage and distribution of CNG. Prices are as at Indian market (one Kg.=Ind. Rs. 18.9).

The Government tax revenue are using for the provision of social security services which includes health, education etc. It is important noted that total tax revenue collection from these three categories (Motor Car, Vans, and Three Wheelers) are amounting to SLRs.61 billion per annum (2008). This section is identifying the appropriate tax scenario taking in to consideration that current economic growth of the country remained in same range of economic growth as demand for vehicle ownership has Pearson Correlation between GDP growth and vehicle ownership growth at 0.88.

Table 8 - Economic and Environment Evaluation (Unit Cost) for Eco friendly Cars

Base Case Scenario (June, 2008)				Gasoline(Eco)	96.50	SLRs.	CNG
				Auto Gas	64.98	SLRs.	Hybrid (per Km)
	(in SLRs. Current rupees)			Diesel(Eco)	95.78	SLRs.	Electric (per Km)

Vehicle Category	Value Addition	Cost Vehicle CIF Value	Health Cost	Global Env. Cost	Fuel Cost(Eco)	Spareparts(Eco)	Total Benefit/ Cost
Car - LPG	2,640,000	1,500,000	3,300	207	556,971	288,000	1,791,522
Car - CNG	2,640,000	1,600,000	1,886	1	282,764	312,000	2,043,350
Car - Elecric Powered	1,408,000	1,550,000	0	0	62,720	140,800	1,204,480
Car - Hybrid	3,960,000	2,400,000	2,121	42	1,308,600	558,000	2,091,237

Source: Toyota Japan, Micro Cars, Sri Lanka, and IndraPrasad, India, Barath Petrolium, India

Table 9 - Economic and Environment Evaluation (Unit Cost) for Eco friendly Vans

Base Case Scenario (June, 2008)				Gasoline(Eco)	96.50	SLRs.	CNG
				Auto Gas	64.98	SLRs.	Hybrid (per Km)
	(in SLRs. Current rupees)			Diesel(Eco)	95.78	SLRs.	Electric (per Km)

Vehicle Category	Value Addition	Cost Vehicle CIF	Health Cost	Global Env. Cost	Fuel Cost(Eco)	Spareparts(Eco)	Total Benefit/ Cost
Van - LPG	5,760,000	1,700,000	4,400	413	1,732,800	272,000	2,050,387
Van - CNG	4,608,000	1,750,000	2,011	1	552,960	190,400	2,112,628
Van - Elecric Powered	4,032,000	1,800,000	0	0	109,760	190,400	1,931,840

Source: Toyota Japan, Micro Cars, Sri Lanka, and IndraPrasad, India, Barath Petrolium, India

Table 10 - Economic and Environment Evaluation (Unit Cost) for Eco friendly three-wheelers

Base Case Scenario (June, 2008)				Gasoline(Eco)	96.50	SLRs.	CNG
				Auto Gas	64.98	SLRs.	Hybrid (per Km)
	(in SLRs. Current rupees)			Diesel(Eco)	95.78	SLRs.	Electric (per Km)

Vehicle Category	Value Addition	Cost Vehicle CIF	Health Cost	Global Env. Cost	Fuel Cost(Eco)	Spareparts(Eco)	Total Benefit/ Cost
Three Wheelers (LPG)	756,000	175,000	990	220	162,120	9,240	408,430
Three	819,000	180,000	660	165	36,288	10,010	591,877

Wheelers(CNG)							
Three Wheelers (Electrict)	630,000	210,000	0	0	1,027	4,200	414,773

Source: Toyota Japan, Micro Cars, Sri Lanka, and IndraPrasad, India, Barath Petrolium, India

6. Conclusion & Recommendations

Concerning the health benefit achieved from Electric Powered, Hybrid, CNG & LPG Vehicles, the current vehicle fleet and other vehicle information available as shown in the Table-11 below, number of importation vehicles and their percentages has proposed for next three years. Accordingly, Eco-friendly car percentage is proposed from 0%-39% from year 2008-2011 to replace retiring vehicles and growth of demand petrol/ diesel cars. Similarly for

Vehicles	2008 Vehicle %	2008 No of Vehicles	2009 Vehicle %	2009 No of Vehicles	2010 Vehicle %	2010 No of Vehicles	2011 Vehicle %	2011 No of Vehicles
Car-LPG	0%	0	5%	1058	7%	1649	10%	2863
Car-CNG	0%	0	2%	424	5%	1178	7%	2004
Car- Electric Powered	0%	0	2%	424	5%	1178	7%	2004
Car-Hybrid	0%	0	10%	2117	12%	2828	15%	4295
			19%	4023	29%	6833	39%	11166
Van- LPG	0%	0	5%	148	7%	211	10%	312
Van-CNG	0%	0	5%	148	7%	211	10%	312
Van- Electric Powered	0%	0	10%	297	12%	361	15%	468
			20%	593	26%	783	35%	1092
TW- LPG	0%	0	10%	3940	12%	3721	15%	5418
TW-CNG	0%	0	15%	5910	17%	5270	20%	7224
TW- Electric Powered	0%	0	15%	5910	17%	5270	20%	7224
			40%	15760	46%	14261	55%	19866

Eco-friendly van and three-wheelers have increased by 35% and 55% respectively, by year 2011. This has been treated as selected scenario.

Table-11: Proposed number of importation vehicles and their percentages for year 2009-2011

Car- (Petrol) Brand New								
Car- (Petrol) Used	94.5%	22760	77.30%	16369	67.8%	15976	57.3%	16405
Car- (Diesel) Brand New								
Car- (Diesel) Used	5.5%	1324	3.70%	784	3.20%	754	3.70%	1059
Total Cars -Diesel & Petrol	100%	24084	81.00%	17153	71.0%	16730	61.0%	17464
Van-(Diesel) Brand New								
Van-(Diesel) Used	100%	2670	80%	2377	74%	2229	65%	2028
TW (Petrol)	100%	43701	60%	23640	54%	16742	45%	16254

Below Table-12 shows the proposed Tax Structure revealed from the model shown in the Annex-2 for year 2008-2011. The revenue for years 2008-2011 has been kept as constant and the tax structure has been adjusted with the replacement in numbers of eco-friendly vehicle categories. Tax structure for all taxes except for excise duty has maintained in the similar form for the period and simulated the excise duty until achieved the desired level of revenue. Excise duty, being the significant revenue earned through importation, has been considered mainly for this proposed tax structure. The Equation is developed to prioritized and changed the fleet mix shifting to eco-friendly and economic (fuel efficient (Hybrid, Electric, CNG, LPG), viability vehicles. The petrol and diesel vehicles fleet is reducing through market base instruments discussed in the report. The model has similar tax structure including the Excise duty is proposed to maintain for consecutive three years (2009 to 2011). Revenue achievement through the proposed tax structure and the relevant equations are shown in Annexure IV.

It is revealed in the analysis that country need a forward and rational tax policy to achieved economically viable and environmentally friendly vehicle fleet in order to achieve the sustainable economic growth in far with government policies. The recommended tax structure has included all these objectives.

Table 12: Proposed Tax structure for year 2008-2010

Vehicles	CIF Value	Total Benefit/Cost	Import	Cess	PAL	SUR	Excise (2008)	Excise (2009)	Excise (2010)	VAT	RADL	SRL	Total	Total	Total
Car-LPG	1,500,000.00	1,791,522.00	28%	10%	3%	15%	0%	50%	50%	20%	5%	1.5%	0.0%	132.5%	132.5%
Car-CNG	1,600,000.00	2,043,350.00	28%	10%	3%	15%	0%	50%	50%	20%	5%	1.5%	0.0%	132.5%	132.5%
Car- Electric Powered	1,550,000.00	1,204,480.00	28%	10%	3%	15%	0%	44%	44%	20%	5%	1.5%	0.0%	126.5%	126.5%
Car-Hybrid	2,400,000.00	2,091,237.00	28%	10%	3%	15%	0%	40%	40%	20%	5%	1.5%	0.0%	122.5%	122.5%
Van- LPG	1,700,000.00	2,050,387.00	28%	10%	3%	15%	0%	55%	55%	20%	5%	1.5%	0.0%	137.5%	137.5%
Van-CNG	1,750,000.00	2,112,628.00	28%	10%	3%	15%	0%	55%	55%	20%	5%	1.5%	0.0%	137.5%	137.5%
Van- Electric Powered	1,800,000.00	1,931,840.00	28%	10%	3%	15%	0%	50%	50%	20%	5%	1.5%	0.0%	132.5%	132.5%
TW- LPG	175,000.00	408,430.00	15%	0%	3%	0%	0%	0%	0%	20%	0%	1.5%	0.0%	39.5%	39.5%
TW-CNG	180,000.00	591,877.00	15%	0%	3%	0%	0%	0%	0%	20%	0%	1.5%	0.0%	39.5%	39.5%
TW- Electric Powered	210,000.00	414,773.00	15%	0%	3%	0%	0%	0%	0%	20%	0%	1.5%	0.0%	39.5%	39.5%
Car- (Petrol) Brand New	1,600,000.00	944,941.00	28%	10%	3%	15%	44%	88%	88%	20%	5%	1.5%	126.5%	170.5%	170.5%
Car- (Petrol) Used	1,200,000.00	251,396.00	28%	10%	3%	15%	44%	88%	88%	20%	5%	1.5%	126.5%	170.5%	170.5%
Car- (Diesel) Brand New	1,650,000.00	312,682.00	28%	10%	3%	15%	120%	200%	200%	20%	10%	1.5%	207.5%	287.5%	287.5%
Car- (Diesel) Used	1,300,000.00	(-)279705	28%	10%	3%	15%	120%	200%	200%	20%	10%	1.5%	207.5%	287.5%	287.5%
Van-(Diesel) Brand New	1,650,000.00	1,566,724.00	28%	10%	3%	15%	88%	120%	120%	20%	7.5%	1.5%	173.0%	205.0%	205.0%
Van-(Diesel) Used	1,400,000.00	476,329.00	28%	10%	3%	15%	88%	120%	120%	20%	7.5%	1.5%	173.0%	205.0%	205.0%
TW (Petrol)	630,000.00	218,607.00	15%	0%	3%	0%	4%	4%	4%	20%	0%	1.5%	44%	43.5%	43.500%

These evaluations have derived an optimal recommendation for the tax structure within the framework of objectives. Analysis has concluded with three scenarios and derived the calculation through a equation developed for this purpose. It is recommended the Scenario three to be implemented which may achieved the short term objectives.TheTable-13 shows the analysis of the tax option with the different vehicle mix. It is found to be that most economically and environmentally viable option for the Sri Lankan condition is given in the Table-13 considering the above evaluation.

Table 13 – Recommended Option for the Tax Structure (Economically and Environmentally viable)

Tax Category	Motor Car 800 CC to 1300 CC (Petrol)	Motor Car 1301 CC to 1500 CC (Petrol)	Motor Car more Than 1500 CC (Petrol)
Import Duty	28 %	28%	28%
Cess	10%	10%	10%
PAL	3%	3%	3%
SUR	15%	15%	15%
Excise Duty	44%	88%	120%
VAT	20%	20%	20%
RADL	5%	10%	10%
SRL	1.5%	1.5%	1.5
Total	126.5	175.5	207.5

Tax Category	Motor Car 1500 CC to 2000 CC (Diesel)	Motor Car 2001 CC to 2500 CC (Diesel)	Motor Car more Than 2500 CC (Diesel)
Import Duty	28 %	28%	28%
Cess	10%	10%	10%
PAL	3%	3%	3%
SUR	15%	15%	15%
Excise Duty	160%	200%	240%
VAT	20%	20%	20%
RADL	5%	10%	10%
SRL	1.5%	1.5%	1.5
Total	242.5	287.5	327.5

Tax Category	LPG 1000 CC to 1499 CC (Diesel)	CNG Motor Car 1000 CC to 1499 CC (Diesel)	Electric Power 800 CC 1400 CC	Hybrid Motor Car 1200 CC to 1600 CC
Import Duty	28.0	28.0	28.0	15.0
Cess	10.0	10.0	10.0	10.0
PAL	3.0	3.0	3.0	3.0
SUR	15.5	15.5	15.5	15.5
Excise Duty	22.0	11.0	00	00
VAT	20.0	20.0	20.0	20.0
RADL	5.0	5.0	5.0	10.0
SRL	1.5	1.5	1.5	1.5
Total	105.0	95.0	83.0	75

Tax Category	Vans/ Dual Purpose Vehicles: 2000 CC to 2400 CC (Diesel)	Vans/ Dual Purpose Vehicles: 2400 CC to 2800 CC (Diesel)	Vans/ Dual Purpose Vehicles: 2800 CC and more (Diesel)
Import Duty	28.0	28.0	28.0
Cess	10.0	10.0	10.0
PAL	3.0	3.0	3.0
SUR	15.0	15.5	15.0
Excise Duty	200.0	240.0	260.0
VAT	20.0	20.0	20.0
RADL	10.0	10.0	10.0
SRL	1.5	1.5	1.5
Total	287.5	328.0	337.5

Tax Category	Three Wheelers (Petrol)	Three Wheelers (Diesel)	Three Wheelers (LPG)	Three Wheelers (CNG)	Three Wheelers (Electric)
Import Duty	28.0	28.0	15.0	15.0	15.0
Cess	0.0	0.0	0.0	0.0	0.0
PAL	3.0	3.0	3.0	3.0	3.0
SUR	0.0	0.0	0.0	0.0	0.0
Excise Duty	10.0	20.0	0.0	0.0	0.0
VAT	15.0	20.0	15.0	15.0	15.0
RADL	0.0	0.0	0.0	0.0	0.0
SRL	1.5	1.5	1.5	1.5	1.5
Total	57.5	72.5	34.5	34.5	34.5