RUNNING DRY: ASSESSING THE FUEL LEVY AS A LONG TERM, ECONOMICALLY EFFICIENT ROAD USE FUND

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ABSTRACT

The fuel levy, a domestic transport cost component added to the basic fuel price, has long been South Africa's main source of income to fund the construction and maintenance of roads as well as lend support to public transport (National Treasury, 2014b). During the 2012 / 2013 financial year the fuel levy contributed R40.4 billion to the National Revenue Fund administered by National Treasury (The Citizen, 2013). Of this amount, R17.6 billion (44.0%) and R19.9 billion (49.0%) were allocated to the road and public transport sectors respectively. Recent comments regarding the Gauteng Freeway Improvement Project (e-toll) has raised questions and strong opinions about the continuing use of the fuel levy as the main or only source of income from road users to fund land transport operations and infrastructure in South Africa.

The aim of this paper is to assess if a review of the fuel levy is needed, and to be supplemented or replaced by a viable alternative, in order to secure a long term sustainable income source for the country's aging transport road infrastructure.

This paper will provide a historic overview of the South African fuel levy, from its origins in the 1920's to the present day and will review the current demands on the fund. This will be followed by a comparison between the fuel levy in South Africa and other countries, including selected BRICS nations and selected European countries. Various societal trends will then be considered including alternative fuels, electrical and more fuel efficient vehicles and the impact of these trends on the fuel levy will be assessed.

It was found through this assessment that alternative fuels, electrical and more fuel efficient vehicles have had an impact on the fuel levy whereby the registered vehicle population in South Africa grew with 47.2 % between the periods 2003 to 2012. For the same periods the vehicle kilometres driven by the registered vehicle population grew with 38.5 % while the fuel sales only grew by 21.9 %. This had a result where the fuel levy is losing productivity by experiencing declining revenues.

The paper concludes that a review of the current fuel levy is needed, as increasing the fuel levy each year will only be a temporary solution. An alternative financing mechanism must be implemented that is not affected by societal trends.

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1. INTRODUCTION

It is contended that the fuel levy was and remains an economic efficient[1] way to collect income from road users (OUTA[2], 2015). Proponents state that there is an existing mechanism to administer it and no additional infrastructure such as toll booths, retail billing systems or enforcement issues needs to be implemented. Secondly, distance travelled and weight of the vehicle are some of the primary factors influencing vehicle fuel consumption, so the fuel levy is relatively a good match for the cost incurred by vehicles on our roads. Thirdly, the fuel levy adds costs to all forms of road trips, removing incentives to use back-roads. Furthermore driving during the peak traffic period will give rise to higher fuel consumption given the stop-start nature of traffic, so the fuel levy acts, in some small way as a type of congestion charge.

Opponents to the fuel levy state that this tax is not without problems. Firstly, while the fuel levy is levied nationally it is used to fund roads in specific regions, thus there is a spatial mismatch between those who pay (everyone) and who benefit (the region). Secondly, if the fuel levy is not levied nationally, it will give rise to increased arbitrage opportunities near periphery regions. Thirdly, electrical and hybrid vehicles do not contribute to the fuel levy even though they incur road use cost (i.e. maintenance and congestion). Fourthly, increasing the fuel levy also has a negative impact on socio-economic deprived population classes as it is a regressive tax where everyone pays the same[3]. Effectively lower income car users will be hit hardest by the fuel levy increase as they do not have as much disposable income as higher income car users. Road users do not really consider the fuel levy when driving and the levy do not really induce people to change travel behaviour. Advances in vehicle technology will result in vehicles becoming more fuel efficient and result in less fuel being used for travelling the same distance. Increasing the fuel levy, will have a corresponding increase on transport prices and costs which will have an impact on inflation. It is estimated that a 10% increase in the price of fuel results in a 0.7% point increase in consumer inflation (net of food prices) after seven months (Kantor & Barr, 1986).

The aim of the paper is to assess whether a review of the fuel levy as principle income source is needed, and whether the levy should be supplemented or replaced by a viable alternative.

The paper is structured in five sections. Section 2 provides a historic overview of the South African fuel levy and discusses how the levy is collected and how revenue is distributed to the various role-players. Section 3 compares the South African fuel levy to selected BRICS nations and selected European countries. The next section considers various transport trends and studies the impact thereof on the fuel levy. The paper concludes with a discussion on why a review of the fuel levy is needed, and to possibly be replaced by a viable alternative.

[1] A broad term that implies an economic state in which every resource is optimally allocated to serve each person in the best way while minimising waste and inefficiency.

[2] OUTA is a civic action group of business associates and individuals that was found in March 2012 to challenge SANRAL's decision to implement e-tolling of the recently upgraded freeway network in Gauteng, on the basis that it was irrational, unreasonable and illegal.

[3] A regressive tax is a tax unrelated to income that tend to bear hardest on those least able to pay.

2. HISTORIC OVERVIEW OF THE SOUTH AFRICAN FUEL LEVY

Road construction, before 1935 was the responsibility of provincial and local authorities (Floor, 1984). During this period, transport over long distances within the borders of the country was entrusted to the government. Since the rail system was mainly used exclusively for long distance transport it was developed by government whereas roads, seen as transport over short distances, had to be developed for local interest. The construction and maintenance of roads and bridges was mainly funded through local tax income (Floor, 1984).

Following reports from the Holmwood- and Le Roux commission between 1925 and 1935 it was decided by government that a new national road policy needs to be adopted, grounded on the principle that the financing of roads which are of national importance must be the responsibility of central government and that tax from users of the public roads must be charged to achieve this goal (Van Lingen, 1960). This resulted in the establishment of the National Roads Board (National Roads Act No 42 of 1935), as well as the establishment of a National Road Fund in 1935 to fund mainly national roads for national development and unity (Floor, 1984). Fund revenue was sourced from a percentage of the import tax from every litre of fuel imported (3 pennies per gallon) since 31 March 1935 (Van Lingen, 1960).

The relationship between the National Roads Board and provincial authorities was never good and deteriorated by 1944 (Floor, 1984). This resulted in the dissolvent of the board and the establishment of the National Transport Commission in December 1948 (Van Lingen, 1960). The National Road Fund still collected 3 pennies per gallon which accumulated to £3.3 million for 1949/50. In 1950 it was agreed to increase the tax to 6d per gallon of fuel imported (Floor, 1984).

By 1958 it became apparent that the National Road Fund needed to acquire more revenue and thus Parliament decided to increase the fuel tax to 8½d per gallon. This was done in order to repay bonds from National Treasury by 1961 and to establish a fund for the construction of urban highways that was planned (Floor, 1984). By 1961 the fund was unable to repay all Treasury bonds but was able to invest in construction of highways in Johannesburg, Cape Town, Durban and Port Elizabeth. In the same year the government agreed that the fund would acquire their income from a tax on all imported and locally produced petrol, diesel, oil and paraffin. With the decimalisation of the currency the income was set at 5.35 cents per gallon (Floor, 1984).

Over the next 12 years it was planned that the fund would distribute 60% of the income for construction or reconstruction of national roads and bridges. A further 12% for building new urban freeways in metropolitan areas; 11.5% of the fund was reserved for assisting on special roads and 8% for maintenance. This represented a 91.5% allocation to roads (Floor, 1984).

By March 1972 the fund had R63 million in the bank due to a tax increase to 1.75 cents per litre of fuel sold (Floor, 1984). The fund experienced declining revenues since 1974 due to a decrease in fuel use as a result of the savings regulations that was implemented by government. This was necessary due to international sanctions that arose from the anti-apartheid movement against the National Party in South

Africa. Tax increased to 2.579 cents per litre of fuel sold by 1977 but despite these increases the income of the National Road Fund stayed inadequate to keep trend with the approved road building programme (Floor, 1984).

In 1980 a Government delegation visited the Far East where toll roads created a favourable impression on government as a means to raise additional revenue (Lishman, 2013). Based on this experience, government argued that toll roads would be a less inflationary means of raising additional revenue than a rise in the price of fuel. Additional benefits cited include that toll roads would have local effect on prices and the toll would be linked to the increase in productivity or savings in operating costs which the user of the toll would achieve. After investigation by the National Transport Commission, authority to charge tolls was eventually granted. The National Roads Act no 54 of 1971 was amended by the National Roads Amendment Act no 79 of 1983. The new legislation provided for tolls to fund new roads, or road improvements, on stretches where an alternative route existed, i.e. initially traffic deviation was presumed and built into the system. The first modern toll road followed in June 1984 when the Tsitsikamma Toll road was opened to traffic (Floor, 1984).

From 1983 to 1988 the National Road Fund was funded by a dedicated, ring-fenced fuel levy[4], in addition to tolls. The situation changed in 1988 when the Act was amended by the then minister of finance, Minister Barend du Plessis and the ring-fenced fuel levy was changed to a general levy where the income could be used for other government expenditure programmes. Since 1988 the income from the fuel levy is allocated into the National Revenue Fund, administered by National Treasury. National Treasury then allocates money to provinces to fund transport operations and infrastructure. This allocation is outlined in the "*Annual Estimates of National Expenditure"* report that is compiled each year, which sets out the structure of the national government budget (National Treasury, 2014).

2.1 The current fuel levy

The objective of the current fuel levy is to raise revenue to fund general expenditure programmes, including the construction and maintenance of roads and to *support of public transport* (National Treasury, 2014b). Previously the fund *did not* finance operational or capital investment in public transport and the fund is also not ring fenced for transport or roads in particular.

During the 2012 / 2013 financial year the fund collected, on average, 197.5 cents per litre petrol and 182.5 cent per litre diesel sold which accumulated to R 40.4 billion (Engen, 2014). The Department of Transport had an annual budget for the 2012 / 2013 financial year of R 39.3 billion (The Citizen, 2013) which was allocated from National Treasury (Figure 1). Of this amount the Department made payments of R 37.8 billion.

This included payments of R19.9 billion (49%) to public transport. Municipalities received R 4.8 billion (12%) for public transport infrastructure systems and a further R4.3 billion (11%) to provinces for public transport operations (bus subsidies). R10.2 billion (25%) went to PRASA to fund the commuter rail system. R400 million was earmarked for the taxi recapitalisation program and R200 million to departmental

[4] Guarantee that (funds allocated for a particular purpose) will not be spend on anything else.

agencies for road and rail regulation. Furthermore the department made payments of R17.6 billion (44%) to roads which account for 44 cents out of every rand collected. R9.7 billion (24%) was allocated to SANRAL and the provinces received R 7.9 billion (20%) for road maintenance grants. The remainder of the tax revenue, R300 million, is used for rural road asset management in municipalities; Taxi operations and search and rescue services; capacity development for universities and technikons; membership fees; sponsorships and leave gratuity.

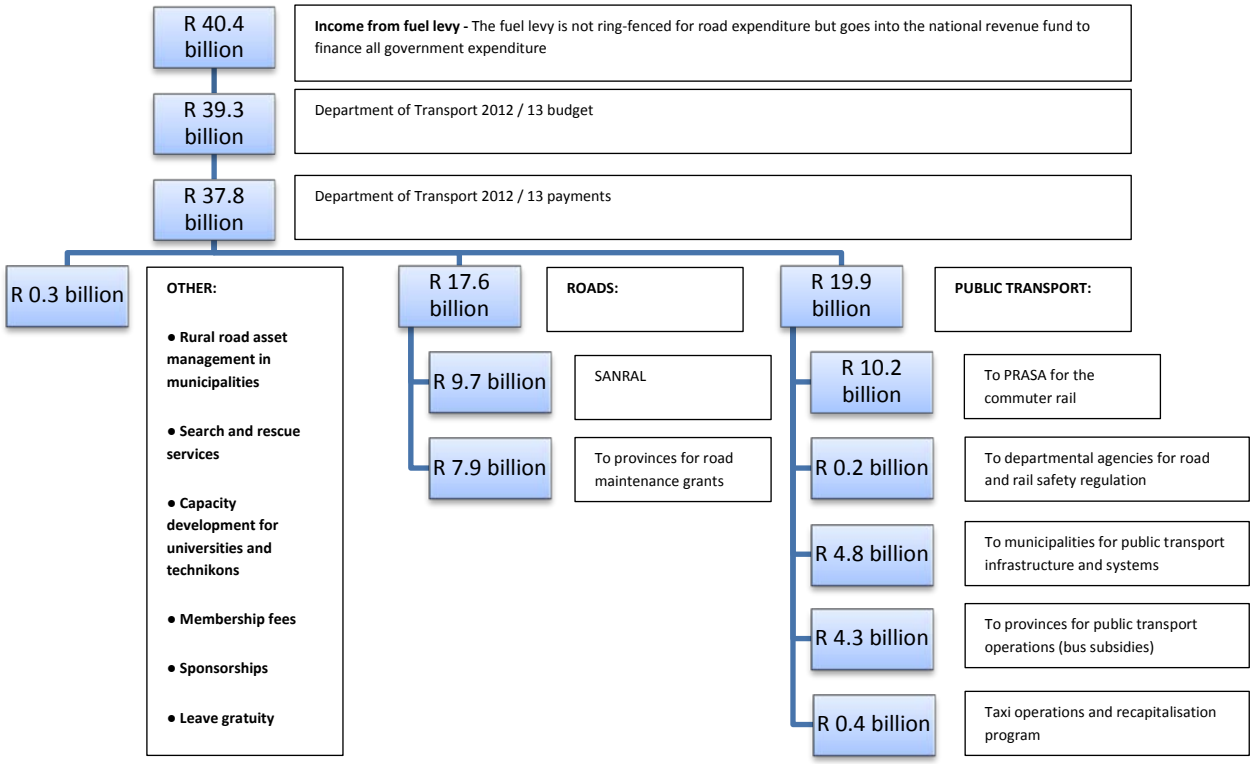


Figure 1: Distribution of the fuel levy to various role-players (The Citizen, 2013), (confirmed by National Treasury on 2 Feb 2015)

Currently the government invests 5% more in public transport than on roads. Income from public transport was not considered in this calculation.

3. COMPARISON OF FUEL LEVIES

Table 1 compares the petrol and diesel fuel levy, in US cents, for the selected BRICS and OECD countries. Generally, countries with a better public transport system tend to have a higher fuel levy than counties with a relatively poor system. In 2012 South Africa was ranked 8th highest (out of 11 countries) in terms of the fuel levy amount for petrol and 5th highest for diesel. In absolute terms, South Africa's fuel levy is relative low compared to the BRICS and OECD nations.

Table 1: Fuel levy per litre of Petrol / Diesel ($ cents) (2004 to 2012) (METSCHIES, 2007 - 2013) ; (ENGEN, 2014) ; (OECD, 2014)

		BRICS					OECD					
		South Africa	Brazil	Russia	India	China	Australia	New Zealand	Germany	UK	USA	Canada
2004	Fuel levy: Petrol	10	39	10	42	3	40	32	101	111	9	23
	% of petrol price	26.3%	46.4%	18.2%	48.3%	1.9%	47.1%	51.6%	69.2%	71.2%	16.7%	33.8%
	Fuel levy: Diesel	9	5	1	18	0	39	0	85	116	13	24
	% of diesel price	25.3%	10.2%	2.2%	29.2%	0.0%	47%	9.8%	65.9%	72.5%	22.8%	38.3%
2006	Fuel levy: Petrol	10	42	11	46	3	35	40	100	109	11	28
	% of petrol price	17.1%	33.6%	14.1%	45.2%	1.9%	37.8%	40.9%	64.6%	66.6%	17.9%	33.0%
	Fuel levy: Diesel	9	3	1	10	0	35	8	77	112	13	14
	% of diesel price	15.3%	3.4%	0.9%	13.5%	0.0%	37.4%	11.4%	55.9%	64.5%	18.2%	17.3%
2008	Fuel levy: Petrol	11	37	10	40	3	26	42	98	79	8	21
	% of petrol price	12.5%	29.6%	10.8%	36.9%	1.5%	34.6%	38.6%	52.6%	61.9%	15.1%	27.6%
	Fuel levy: Diesel	10	3	1	10	0	31	10	80	98	11	14
	% of diesel price	9.9%	2.8%	0.7%	14.7%	0.0%	33.0%	11.4%	51.3%	57.8%	14.0%	15.3%
2010	Fuel levy: Petrol	15	57	15	61	4	47	66	118	122	13	38
	% of petrol price	21.5%	36.0%	17.4%	53.3%	2.3%	37.0%	44.8%	62.2%	63.8%	17.0%	31.6%
	Fuel levy: Diesel	14	4	1	13	0	48	11	91	124	15	18
	% of diesel price	20.7%	3.2%	1.0%	16.3%	0.0%	38.9%	11.4%	54.3%	62.8%	17.6%	16.5%
2012	Fuel levy: Petrol	18	59	15	64	5	47	71	109	129	13	39
	% of petrol price	17.9%	42.5%	15.3%	50.9%	2.1%	33.7%	40.3%	55.6%	59.5%	13.6%	29.2%
	Fuel levy: Diesel	16	4	1	15	0	54	16	89	131	14	20
	% of diesel price	16.7%	4.1%	0.8%	17.6%	0.0%	34.5%	13.3%	47.5%	57.3%	13.4%	16.4%

Table 2 provides some general country statistics. South Africa is ranked 8th highest out of 11 countries in terms of population size, 9th highest in terms of GPD growth per capita, 9th highest in terms of vehicles per 1000 of population, 8th highest in terms of country size, 5th highest in terms of road density and 7th highest in terms of price per litre of fuel (CIA, 2014) (The World Bank, 2015).

Table 2: Country statistics
(CIA, 2014), (The World Bank, 2015)

		Classification	Population	GDP per capita ($) (2013)	Vehicles per 1 000 of population	Country size km²	Road density (km/km²)	Fuel price 2014 $/L
BRICS	**South Africa**	Upper middle income	48 375 645	6 886	165	1 219 090	0.5	1.2
	Brazil	Upper middle income	202 656 788	11 208	724	8 514 877	0.2	1.5
	Russia	High income	142 470 272	14 611	300	17 098 242	0.1	0.9
	India	Lower middle income	1 236 34 4 631	1 497	41	3 287 263	1.4	1.1
	China	Upper middle income	1 355 69 2 576	6 807	69	9 596 960	0.5	0.9
OECD	**Australia**	High income	22 507 617	67 463	703	7 741 220	0.1	1.4
	New Zealand	High income	4 401 916	41 824	708	267 710	0.4	1.8
	Germany	High income	80 996 685	46 251	588	357 022	0.1	1.8
	UK	High income	63 742 977	41 781	516	243 610	1.6	1.9
	USA	High income	318 892 103	53 042	786	9 826 675	0.7	0.8
	Canada	High income	34 834 840	51 964	607	9 984 670	0.1	1.2

4. VEHICLE GROWTH AND THE FUEL LEVY

Table 3 shows that the registered vehicle population[5] of South Africa increased by 47.2% over the period 2003 to 2012 at an average annual growth rate of 4.4%. The registered vehicle *ownership per capita*[6] increased by 60 vehicles per 1000 of the population over the same period.

[5] The registered vehicle population includes motorcars; minibuses; buses; motorcycles; light delivery vehicles and other / unknown.
[6] Motor vehicles owned per person of the population of the country.

Table 3: Registered vehicle population, annual kilometres travelled and fuel volume used (Road Traffic Management Corporation, 2014), (DOE - SA, 2014)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003 - 2012
Vehicles ('000 000) (#)	7.2	7.5	8.0	8.5	9.1	9.3	9.3	9.8	10.2	10.6	3.4
Change	-	*292 641*	*492 010*	*573 715*	*523 715*	*236 388*	*40 722*	*484 170*	*363 652*	*417 559*	-
% change	-	*4.1 %*	*6.6 %*	*7.2 %*	*6.1 %*	*2.6 %*	*0.4 %*	*5.2 %*	*3.7 %*	*4.1 %*	*47.2%*
% avg annual growth	-	-	-	-	-	-	-	-	-	-	*4.4%*
SA Population ('000 000) (#)	*46.4*	*46.4*	*47.0*	*47.6*	*48.2*	*48.9*	*49.5*	*50.2*	*50.8*	*51.5*	*5.1*
Vehicles per 1000 of population (#)	*150*	*160*	*170*	*170*	*180*	*190*	*190*	*200*	*200*	*210*	*60*
Kilometres ('000 000) (kms)	117 875	122 441	125 504	128 295	134 872	129 740	143 837	151 289	156 886	163 313	45 438
Change	-	*4 566*	*3 062*	*2 792*	*6 577*	*-5 132*	*14 097*	*7 452*	*5 597*	*6 427*	-
% change	-	*3.9 %*	*2.5 %*	*2.2 %*	*5.1 %*	*-3.8 %*	*10.9 %*	*5.2 %*	*3.7 %*	*4.1 %*	*38.5%*
% avg annual growth	-	-	-	-	-	-	-	-	-	-	*3.7%*
Petrol ('000 000) (L)	10 425	10 766	10 948	11 030	11 324	10 847	11 076	11 207	11 705	11 460	1 035
Diesel ('000 000) (L)	5 046	5 370	5 676	6 091	6 831	6 832	6 209	6 691	7 385	7 409	2 363
Total ('000 000) (L)	15 471	16 136	16 623	17 121	18 155	17 680	17 285	17 898	19 089	18 870	3 399
Change	-	*665*	*488*	*497*	*1 035*	*-476*	*-395*	*613*	*1 191*	*-219*	-
% change	-	*4.3*	*3.0*	*3.0*	*6.0*	*-2.6*	*-2.2*	*3.6*	*6.7*	*-1.2*	*21.9%*
% avg annual growth	-	-	-	-	-	-	-	-	-	-	*2.3%*
GDP growth	2.9	4.6	5.3	5.6	5.5	3.6	-1.5	3.1	2.5	1.9	-

Table 3 also shows that the *vehicle kilometres* travelled by the registered vehicle population increased by 38.5% at an average annual rate of 3.7% between the period 2003 to 2012[7].

Furthermore the fuel volume used by the registered vehicle population increased by 21.9% at an average annual rate of 2.3% between the period 2003 to 2012. For petrol this relates to an increase of 1 035 million litres (9.9%) and for diesel to an increase of 2 363 million litres (46.8%) respectively.

[7] Due to lack of data for vehicle kilometres travelled during the period 2009 and 2012, the data was estimated by averaging the kilometres per vehicle during the period 2003 to 2008 and then multiplying with the number of vehicles during the period 2009 to 2012.

New advances in technology are making road vehicles more fuel efficient each year. Between 1970 and 2012 the average fuel efficiency[8], of all vehicle types increased by 32% at an average rate of 0.9% per annum (US Energy Information Administration, 2015). Roughly translated this implies that 2012 model vehicle can travel 32% further than a 1970 model vehicle, using the same fuel amount, and paying the same fuel levy. The introduction of electric vehicles and bio-fuels into the market will further contribute to fuel efficiency. In 2013 the Nissan Leaf[9], an entirely electric powered vehicle was introduced into the South African market serviced by 9 charging stations (Nissan South Africa, 2015).

Figure 2 illustrates the gap between the registered vehicle population, annual kilometres travelled by the registered vehicle population and the fuel sales in South Africa. The proportional growth in registered vehicles and kilometres travelled exceeds the growth in fuel sales by 25.3% and 16.6% respectively. Stated differently, the fuel levy is less productive compared to the other indices as it is directly linked to fuel sales.

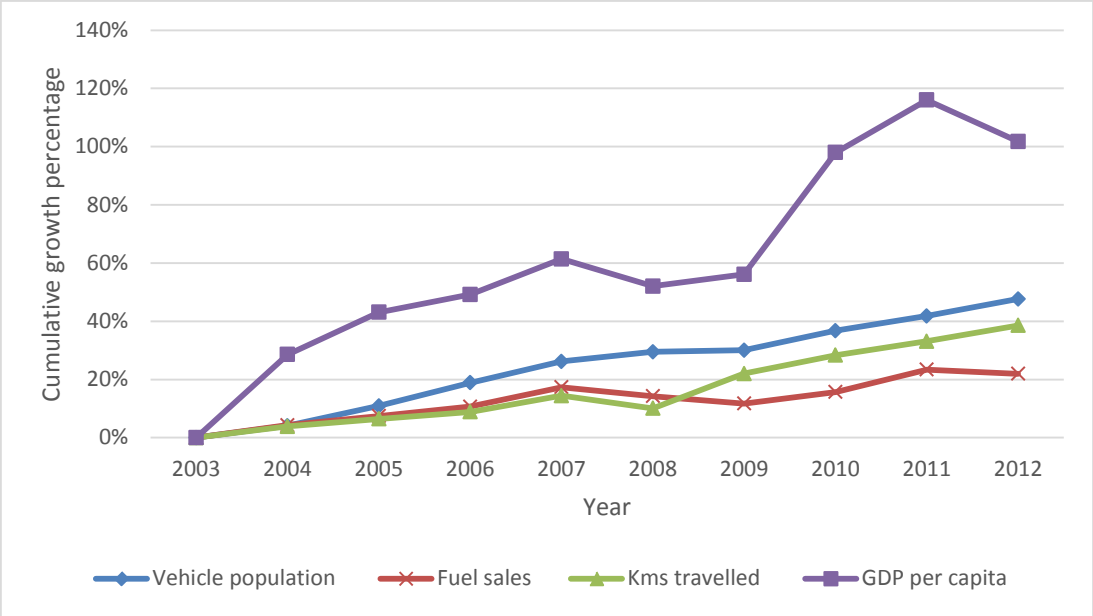


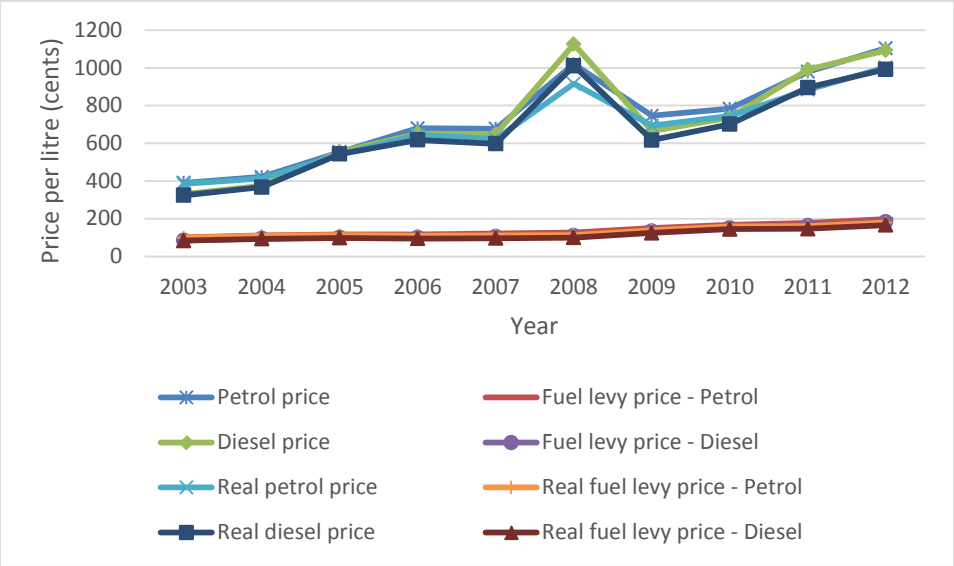
Figure 2: Cumulative growth: registered vehicle population, kms travelled and fuel sales
(METSCHIES, 2013) ; (ENGEN, 2014) ; (OECD, 2014)

This trend between vehicles population growth, annual kilometres travelled and an unproductive annual fuel levy is not unique to South Africa. This phenomenon is also experienced in various countries including America, Germany, United Kingdom, Sweden, Australia, New Zealand and Singapore. Most of these countries are searching for viable alternatives to the declining fuel income source (Sorensen & Taylor, 2005; Whitty, 2007; Abou-Zeid, Ben-Akiva, Tierney, Buckeye, & Buxbaum, 2008).

[8] The relationship between the distance travelled and the amount of fuel consumed by the vehicle.
[9] Over 100 000 vehicles sold worldwide, of which 48 vehicles in South Africa.

4.1 Fuel and fuel levy price per litre of fuel sold

Figure 3 illustrates that the petrol and diesel price increased by 714 cents (183%) and 763 cents (231%) respectively between the years 2003 to 2012. Over the same period the petrol and diesel fuel levy increased by 97 cents (96%) and 98 cents (115%) respectively. This translates to an annual average growth of 7.1% and 8.1% for petrol and diesel.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Petrol price (c)	390c	422c	533c	680c	677c	1020c	746c	783c	979c	1104c
Fuel levy: Petrol (c)	101c	111c	116c	116c	121c	127c	150c	168c	178c	198c
Diesel price (c)	330c	375c	555c	652c	649c	1125c	664c	736c	991c	1093c
Fuel levy: Diesel (c)	85c	95c	100c	100c	105c	111c	135c	152c	163c	183c
Real petrol price (c)	384c	413c	541c	644c	622c	916c	693c	745c	884c	1002c
Real fuel levy: Petrol (c)	99c	109c	113c	110c	111c	114c	139c	159c	160c	179c
Real diesel price (c)	324c	367c	543c	618c	597c	1011c	617c	701c	895c	992c
Real fuel levy: Diesel (c)	84c	93c	98c	95c	97c	100c	125c	145c	147c	166c

Figure 3: Fuel and fuel levy price per litre of fuel sold c/L (As at August 2014) (Engen, 2014)

4.2 Fuel levy income

Table 4 reveals that the fuel levy fund increased by R21 338 million (average of 10.8% per annum) between 2003 and 2012 as a result of more fuel sold as well as price increases.

Table 4: Annual income from Fuel levy
(RTMC, 2014), (Engen, 2014)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003 - 2012
Fund ('000 000) (R)	14 818	17 051	18 375	18 885	20 875	21 360	24 996	28 942	32 776	36 156	21 338
Change	*1 713*	*2 233*	*1 324*	*510*	*1 990*	*485*	*3 636*	*3 946*	*3 833*	*3 381*	-
% change	*13.1 %*	*15.1 %*	*7.8 %*	*2.8 %*	*10.5 %*	*2.3 %*	*17.0 %*	*15.8 %*	*13.2 %*	*10.3 %*	*10.8%*

Over the same period the average kilometres per registered vehicle decreased by 1 011 kilometres (-6.2%) and that average fuel consumption per registered vehicle decreased by 374 litres (-17.4%) (Table 5). Fuel economy of the registered vehicle population improved by 1.5 L/100 km per vehicle for the period.

Table 5: Average vehicle kilometres and fuel consumption per vehicle per annum
(Road Traffic Management Corporation, 2014), (DOE - SA, 2014)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003 - 2012	
Kilometres (kms)	16 402	16 371	15 745	15 014	14 873	13 944	15 392	15 392	15 392	15 392	1011	-6.2%
Fuel consumption (L)	2 153	2 157	2 085	2 004	2 002	1 900	1 850	1 821	1 873	1 778	375	-17.4%
Fuel economy l/100km	13.1	13.2	13.2	13.4	13.5	13.6	12.0	11.8	12.2	11.6	1.5	-11.4

Measuring the productivity of the fuel levy seems a valuable index to assess the long term income earning potential of the fuel tax. Productivity can be defined as an economic measure of output per unit of input. The measure will determine the additional income (R) generated (*outputs*) per additional vehicle kilometre generated (*inputs*) between the current year under investigation and a base year. The productivity of the fuel levy (*P*) is expressed in the equation 1[10]:

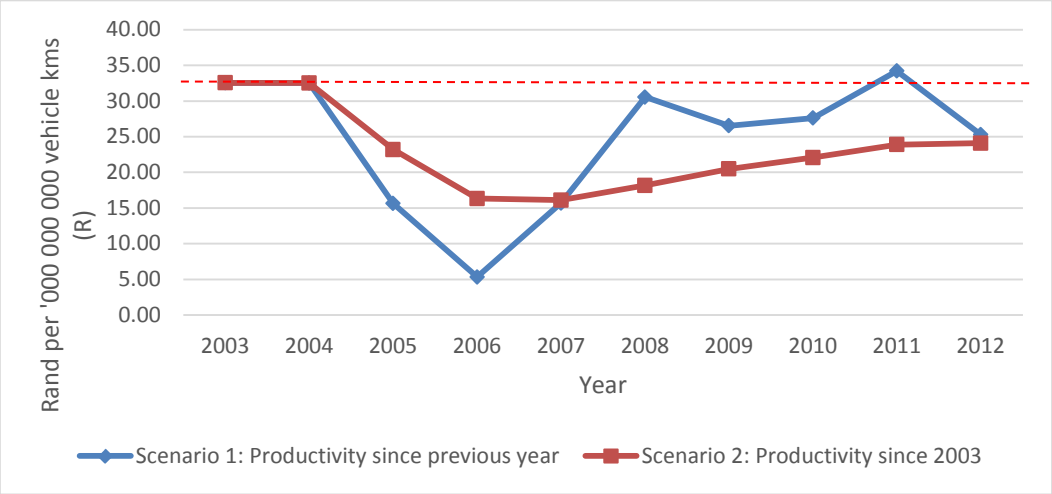
$$P = \frac{\left(\frac{(PFC.PFL)+(DFC.DFL)}{100}\right)^{current\ year} - \left(\frac{(PFC.DFL)+(DFC.DFL)}{100}\right)^{base\ year}}{(VKT.RV)^{current\ year} - (VKT.RV)^{base\ year}}$$

…… (Eq 1)

where
P = productivity of the fuel levy (R)
PFC = fuel consumed per annum – Petrol (L)
PFL = fuel levy – Petrol (c)
DFC = fuel consumed per annum – Diesel (L)
DFL = fuel levy – Diesel (c)
VKT = vehicle kilometres travelled per annum (Km)
RV = registered vehicle population (# Vehicles)

[10] All negative values must be made positive before dividing the outputs above the line into the inputs below the line, as this is only used for interpreting the productivity value. A negative output value means that income decreased and a negative input value means that vehicle kilometres decreased respectively.

In Figure 5 two scenarios are produced to illustrate the productivity of the fuel levy. Scenario 1 calculates the productivity since the previous year and scenario 2 calculates the productivity since 2003.



	Scenario 1: Productivity since previous year			Scenario 2: Productivity since 2003		
	Productivity (R)	**Effect on income (output)**	**Effect on vehicle kilometres (input)**	**Value (R)**	**Effect on income (output)**	**Effect on vehicle kilometres (input)**
2003	32.55	+	+	32.55	+	+
2004	32.53	+	+	32.53	+	+
2005	15.64	+	+	23.20	+	+
2006	5.33	+	+	16.32	+	+
2007	15.69	+	+	16.11	+	+
2008	30.55	+	-	18.17	+	+
2009	26.54	+	+	20.48	+	+
2010	27.62	+	+	22.07	+	+
2011	34.21	+	+	23.88	+	+
2012	25.29	+	+	24.09	+	+

Figure 5: Productivity of the fuel levy

The calculations show that on average the additional income generated by the fuel levy per additional vehicle kilometres[11] incurred has decreased, for both scenarios. This was around R7 between 2003 and 2012 for scenario 1 and around R8 for scenario 2. The fuel levy was at its most productive in 2008 (scenario 1) where the additional income generated was R30.55 for every one billion (short scale) vehicle kilometres that the input decreased. For all other years the income increased together with an increase in vehicle kilometres. The calculations further show that although the fund increased in absolute terms, it failed to generate the same level of income, indicated by red dashed line that was set in 2003. This level was only improved once in 2011 in scenario 1 where the fund collected R34.21 per one billion vehicle kilometres increase.

[11] A proposed measurement of road usage that incorporates the distance travelled on roads that has an impact on road maintenance as well as the number of registered vehicles that has an impact on road capacity provision.

In order to maintain the productivity level of R32.55 per billion vehicle kilometres it is apparent that the fuel levy should have increased by more than it actually increased. Table 6 shows the projection of the fuel levy at a rate that would facilitate this productivity level.

Table 6: Productivity projection of fuel levy (Engen, 2014)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Fuel levy: Petrol (c)	101	111	116	116	121	127	150	168	178	195
Fuel levy: Diesel (c)	85	95	100	100	105	111	135	152	163	183
Fuel levy: Petrol (c) - projected	101	111	124	140	156	156	185	205	212	239
Fuel levy: Diesel (c) - projected	85	95	110	123	138	140	170	190	196	222
Fuel levy difference: Petrol (c)	0	0	8	24	35	29	35	37	34	41
Fuel levy difference: Diesel (c)	0	0	10	23	35	29	35	38	33.5	39.5

It can be seen that during 2004 the fund was as productive as 2003. For the following years the fuel levy had to increase by 8 cent for petrol and 10 cent for diesel more in 2005 and so much as 41 cent for petrol and 39.5 for diesel more in 2012 in order to maintain this productivity. Thus the fuel levy component must account for over 20% of the fuel price. It is apparent that the fuel levy will have to be increased proportionally more each year in the future in order to maintain its productivity which will only be a temporary solution due to the improvement of fuel efficiency and electrical vehicles.

5. CONCLUSIONS AND FINDINGS

This paper is part of ongoing research at Stellenbosch University that considers financing for road transport infrastructure. This paper aims to shed light on the future viability of the fuel levy to fund land transport operations and infrastructure in South Africa. It was illustrated that alternative fuels, electrical and more fuel efficient vehicles have an impact on the fuel levy income. While the registered vehicle population in South Africa grew by 47.2 % between the periods 2003 to 2012, vehicle kilometres increased by 38.5 % but fuel sales only increased by 21.9 %. The result is an increasingly unproductive fuel levy.

A comparison was made between the fuel levy in South Africa and other countries, including selected BRICS nations and selected European countries. It was illustrated that the fuel levy in South Africa is not particularly high compared to these countries. Furthermore the increasingly unproductive fuel levy is not central to South Africa, but other countries are also experiencing these transport economic trends. Many nations are however, actively engaging in projects to find viable alternatives for the income source.

A review of the current fuel levy is needed as increasing the fuel levy each year will only be a temporary solution. The fuel levy must be supplemented or replaced by a viable alternative, in order to secure a long term sustainable income source for the country's aging transport (road) infrastructure.

Future research will consider alternative financing options, including toll roads, GPS enabled road user charging, etc. to supplement the fuel levy.

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