

The differential impact of CO₂ penalties, CO₂ incentives and information policies on consumer behaviour when purchasing a new motor vehicle

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Abstract

The main purpose of this experimental study was to determine the differential impact that a CO

relation to the cost of the new motor vehicles purchased by consumers to have a material impact on the total price. South Africa should also consider whether a CO₂ incentive would be more effective than a CO₂ levy in changing consumers' behaviour when choosing a new motor vehicle. In particular, countries such as Sweden and the Netherlands have successfully used rebates (incentives) to reduce the purchase price and promote the ownership of low-emission vehicles (Huse & Lucinda, 2014, p. F417;

3.1 Independent variables

For purposes of calculating the CO₂ penalty and CO₂ incentive, it was assumed that Model A emits 157 grams of CO₂ per kilometre and Model B emits 119 grams of CO₂ per kilometre. Based on the legislation on CO₂ levies imposed on motor vehicles in South Africa applicable at the time of the study, the CO₂ levy that was payable on Model A, amounted to ZAR 3,700 (at time of writing, increased to ZAR 4,070 which is still approximately 1% of the value of the Model A vehicle as referred to below: South African Revenue Service, 2019). Since Model

Table 3: Calculation of the Future Fuel Costs for Five Years for Model A and Model B

	Model A	Model B
Total kilometres driven in five years	100,000 km	100,000 km
Average fuel consumption	6.5 litres/100 km	4.7 litres/100 km
Litres required for 100 000 km	6,500 litres	4,700 litres
Cost of fuel per litre	ZAR 10.85	ZAR 10.85
Future fuel cost over five years	ZAR 70,497	ZAR 50,975

Table 4 shows the composition of the total cost of ZAR 350,497 for Model A and Model B for all six experiments. The composition of the total cost for Experiments 1 and 4 was the same as both experiments included a CO₂ incentive. For Experiments 2 and 5 the composition was also the same as both experiments included a CO₂ penalty. The composition of the total cost for Experiments 3 and 6 is also the same as both experiments include neither a CO₂ incentive nor a CO₂ penalty.

Table 4: The Total Cost for Model A and Model B for the Six Experiments

	Experiments 1 and 4	
	Model A	Model B
Purchase price (including VAT)	ZAR 280,000	ZAR 310,022
CO ₂ incentive on Model B	-	
Future fuel costs over five years	ZAR 70,497	ZAR 50,975
Total cost	ZAR 350,497	ZAR 350,497
	Experiments 2 and 5	
	Model A	Model B
Purchase price (including VAT)	ZAR 269,500	ZAR 299,522

(ZAR 10

After choosing between Model A and Model B, the participants were also required to respond to questions that measured the impact of the CO₂ incentive or the CO₂ penalty on their choice of model.

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it was to impose a CO₂ penalty of ZAR 10,500 on Model B in order to influence a consumer's choice of motor vehicle, and fourth, how fair the participants thought it was to grant a CO₂ incentive of ZAR 10,500 on Model B in order to influence a consumer's choice of motor vehicle. For the first and third questions, an unbalanced five-point differential semantic rating scale ranging from (1) 'Unlikely' to (5) 'Definitely' was used. For the second and fourth questions, an unbalanced six-point differential semantic rating scale ranging from (1) 'Very unfair' to (6) 'Very fair' was used. The amount of ZAR 10,500 used for the CO₂ incentive and the CO₂ penalty in Experiments 1, 2, 4 and 5 was also used in the four questions in Experiments 3 and 6 to ensure that the results obtained from these questions would be comparable for all six experiments.

3.4 Manipulation check questions and background questions

After the participants had completed the experiment, they were requested to answer 18 short questions. These questions were included to measure and control other factors that might influence a consumer's choice of motor vehicle. For example, a consumer's age, gender, income and opinion about protecting the environment may influence their choice of motor vehicle.

Questions 1, 2 and 3 were the manipulation check questions and Questions 4 to 18 were the background questions. Questions 4 to 18 were the same for all six experiments.

The answers to Question 1 and Question 2 had to be correct in order for the questionnaire to be valid.

3.4.1 *Question 1: manipulation check question for the CO₂ incentive and the CO₂ penalty*

For Experiments 1 and 4, the manipulation check question was a statement and participants had to indicate whether it was true or false. The statement read as follows: 'In this experiment in which I took part, I was granted a CO₂ incentive on one of the two models'. The objective of this question was to determine whether the participants realised that one of the two models had been granted a CO₂ incentive. For Experiments 2 and 5, the manipulation check question was the same as for Experiments 1 and 4 above, except that the statement referred to a CO₂ penalty and not to a CO₂ incentive. The objective of this question was to determine whether the participant realised that a CO₂ penalty was being charged on one of the two models. For Experiments 3 and 6, no CO₂ penalty or CO₂ incentive applied. The manipulation check question required the participants to respond 'true' or 'false' to the statement that Model A and Model B were both not subject to CO₂ penalties or CO₂ incentives or discounts. The objective of this question was to determine whether the participants were aware of the fact that neither one of the two models was subject to CO₂ penalties or CO₂ incentives.

3.4.2 *Question 2: manipulation check question for the level of transparency regarding the future fuel costs of Model A and Model B*

For Experiments 1, 2 and 3, the manipulation check question was a statement and participants had to indicate whether it was true or false. The statement read as follows: 'In this experiment in which I took part, I was given sufficient information to calculate the future fuel costs of Model A and Model B'. The objective of this question was to determine whether the participants were aware that they had been given sufficient information to calculate the future fuel costs of Model A and Model B. For Experiments 4, 5 and 6, the manipulation check question was also a statement to which participants

had to respond by indicating whether they considered it to be true or false. The statement read as follows: 'In this experiment in which I took part, I was given the future fuel costs of Model A and Model B'. The objective of this question was to determine whether

Table 5: Frequency of Demographic Information

Demographic information	<i>N</i>	% of sample
Age		
19 – 24 years	20	8.70%
25 – 34 years	103	44.78%
35 – 44 years	65	28.26%
45 – 54 years	21	9.13%
Older than 55 years	21	9.13%

tax (Alm & Torgler, 2006, p. 224). The objective of this question was to measure whether the participants would be willing to pay more tax if the tax revenue were earmarked for the repair and prevention of environmental pollution. Individuals respond positively when tax proceeds are directed toward programmes of which they approve (Alm, Jackson & McKee, 1993, p. 285). Daude, Gutiérrez and Melguizo (2013, p. 9) explored the drivers of tax morale worldwide with the emphasis on developing countries and concluded that socioeconomic factors such as age, religion, gender, employment status and level of education have a significant impact on people's levels of tax morale. As the background questions had already asked the participants' age, gender and income, it was possible to analyse their answers to Questions 11 and 12 in relation to their age, gender and income. The responses for Question 12 were similar to those of Question 11 since 63.91% of the participants agreed and 36.09% disagreed. When the opinions of men and women were analysed, both had similar opinions regarding an increase in tax to prevent environmental pollution.

The participants were asked to respond to Question 13 by indicating, on a six-point unbalanced Likert scale, how strongly they agreed or disagreed with the following statement: 'It is the government's responsibility to reduce environmental pollution and it should not cost me any additional money'. This question was included specifically as it was significant in the preliminary analysis of the study conducted by Morrow and Rupert (2015, p. 53). The objective of Question 13 was to determine whether the participants were willing to take responsibility for environmental pollution, or whether they preferred to shift the responsibility and cost of environmental pollution on to the government. 69.57% of the participants agreed with this statement.

The objective of Question 14 was to determine whether participants were willing to shift the blame for environmental pollution onto the motor vehicle manufacturers. They were asked to indicate how sM a ca0 1 m

by granting tax incentives?'. 92.61% of the participants agreed that tax incentives should be used.

Question 16 asked how the participants felt about the statement: 'Do you agree that the tax system should be used to discourage certain activities, for example the smoking of cigarettes, by charging tax penalties on cigarette sales?'. Only 76.96% of the participants agreed with this statement. When the results for Questions 15 and 16 are compared, more participants agree that tax incentives should be used which was expected as people want to avoid the emotion of loss or being penalised.

Question 17 was also based on a question used by Morrow and Rupert (2014, p. 53), but was adapted to measure the effectiveness of tax incentives and tax penalties in influencing taxpayer behaviour. A six-point itemised semantic differential scale ranging

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- the participants thought that it was slightly more likely that the CO₂ penalty would change a consumer's behaviour once the future fuel costs were known;
- the participants considered the CO₂ penalty to be more fair once they had been informed of the future fuel costs.

A comparison of the means of these three questions of Experiments 1, 2, 4 and 5

preference for a more fuel-efficient motor vehicle. Finally, the combination of an information policy that gives the estimated future fuel costs of motor vehicles with either a CO₂ penalty or a CO₂ incentive also does not result in a meaningful increase in consumers' preference of more fuel-efficient motor vehicles.

4.3 Relationships between variables

settings (Sekaran & Bougie, 2013, p. 175). Nevertheless, the findings of this study add to the findings of recent studies which concluded that the current CO₂ levy in South Africa is not changing consumers' behaviour when choosing a new motor vehicle (Barnard, 2014, p. 54; Ackerman, 2014, p. 91; Nienaber & Barnard, 2018, p. 151; Carrim, 2014, p. 58).

The contributions of this study are as follows:

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explore the potential impact of a so-

<http://documents.worldbank.org/curated/en/727741468113058335/Tax-policy-to-reduce-carbon-emissions-in-south-Africa>.

Devarajan, S, Go, D S, Robinson, S & Thierfelder, K 2011, 'Tax policy to reduce carbon emissions in a distorted economy: Illustrations from a South Africa CGE model', *The B.E. Journal of Economic Analysis and Policy*, vol. 11, no. 1, article 13.

D'Haultfoeuille, X, Givord, P & Boutin, X 2014, 'The environmental effect of green taxation: The case of the French *bonus/malus*', *The Economic Journal*, vol. 124, no. 578, pp. F444-F480.

South African Revenue Service 2019, *Environmental Levy on Carbon Dioxide Emissions on New Motor*