TRANSPORT
ISSN 1648-4142 / eISSN 1648-3480
Special Issue on Travel Demand Management / 2014 Volume 29(3): 260–268
doi:10.3846/16484142.2014.913261

COULD GREEN TAXATION MEASURES HELP INCENTIVISE FUTURE CHINESE CAR DRIVERS TO PURCHASE LOW EMISSION VEHICLES?

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Submitted 29 October 2013; accepted 14 March 2014; first published online 9 May 2014

Abstract. The paper begins with a brief review of evidence related to the different types of 'green' taxation measures that have been introduced by governments worldwide as a means to lessen the environmental consequences of private car ownership by incentivising the purchase of Low Emission Vehicles (LEV's). An overview is then provided of current understanding of individuals' car purchasing decisions, highlighting gaps in knowledge that exist with current explanatory models. Based on these gaps in knowledge and to investigate the potential of various taxation measures in influencing individuals' car purchasing decisions, an online survey was conducted with students from Dalian University of Technology, China. The questionnaire was designed to measure: (1) situational and psychological factors that would be important for their next car purchase; (2) the impacts of adapting current taxation measures to incentivise LEV purchases; (3) the potential role of a range of taxation measures on their decisions on type of future car purchases. K-Cluster means analysis was employed to identify population segments according to their psychological preparedness and importance attached to situational factors in their future decisions to purchase a LEV, or not. This resulted in three distinct segments – Pro-Greens (33.6% of sample), Maybe-Greens (20.2%) and No-Greens (46.2%). Pro-Greens were more psychologically prepared to purchase LEV's than the other two segments, whose future car purchasing decisions were primarily driven by situational factors (vehicle characteristics, performance, etc.). Pro-Greens were also more likely to be influenced by changes in current Chinese taxation measures (VAT and fuel duty), and also significantly more likely to be influenced by the introduction of future measures that would incentivise LEV purchases than the other two segments. In terms of future measures to incentivise future Chinese drivers LEV purchases and use, the introduction of a feebate system, a CO_2 emissions VAT system, a distance based user charging scheme and annual road tax based on CO_2 emissions would appear to have the greatest potential overall.

Keywords: car purchasing decisions; low emission vehicles; green taxation measures; influencing behaviour; taxation policy.

Reference to this paper should be made as follows: Carreno, M.; Ge, Y.-E.; Borthwick, S. 2014. Could green taxation measures help incentivise future Chinese car drivers to purchase low emission vehicles?, *Transport* 29(3): 260–268. http://dx.doi.org/10.3846/16484142.2014.913261

Introduction

Global concerns over climate change and air quality, including the negative role of transport derived emissions has led governments worldwide to design and implement policy measures in an attempt to persuade people to reduce personal carbon impacts by switching to Lower Emission Vehicles (LEV's). In an attempt to promote and facilitate the uptake of LEV's various governments have introduced a range of taxation measures in an attempt to influence individuals' vehicle purchasing decisions.

These measures can be introduced based on the carbon dioxide (CO_2) emissions of a vehicle, with lower tax payments and/or greater subsidies for LEVs, and the opposite for higher emitting vehicles. Such measures can be implemented at three stages of a vehicle's lifetime, namely:

- ***purchase taxes:*** these are present at the time of sale, including VAT, vehicle purchases taxes and feebates;
- ***circulation taxes:*** regular registration taxes on the ownership of a vehicle, typically occurring every 6/12 months, i.e. annual road/motor tax;

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– ***road fuel taxes:*** apply to the use of a vehicle throughout its lifetime by means of taxation applied to the cost of fuel.

It is however unclear which of the three taxation types will have the greatest impact on vehicle purchasing decisions.

Purchases taxes are suggested to have the greatest potential to shape vehicle purchasing decisions, as they are applied when it is easiest and most convenient for motorists to change between vehicle models (Potter *et al.* 2005). In relation to LEV's, purchase taxes can be differentiated by various factors including engine capacity, power, fuel type CO_2 emissions, or a combination of factors (Brand *et al.* 2013). Feebates, a combination of vehicle purchase tax and subsidy can be used to reward buyers of LEV's and penalise buyers of higher emitting vehicles. Evidence from recent studies in the US (Gordon, Levenson 1989; Gallagher, Muehlegger 2011) and France (D'Haultfoeuille *et al.* 2014; German, Meszler 2010) suggests that with the right combination (fees and rebates) such measures can be highly effective in incentivising LEV purchases.

Circulation taxes are increasingly linked to the vehicle itself (e.g. engine size, CO_2 emissions), irrespective of the degree of usage. Accordingly, vehicle choice decisions at the time of purchase will impact upon future circulation tax payments, implying circulation taxes act in a secondary role to purchase taxes (Potter *et al.* 2005). The requirement for regular payment throughout the duration of vehicle ownership can thus amplify the significance of circulation taxes (Ryan *et al.* 2009). The effectiveness of circulation taxes is shown to be predominately linked to the amount charged (EST 2007), and results obtained regarding their effectiveness are mixed and dependent on the country been studied (Brand *et al.* 2013).

Fuel taxes appearing as a regular visible expense for motorists can have a strong impact upon vehicle usage decisions (Goldberg 1998). Purchasing a LEV will also result in reduced fuel consumption, thus raising the kilometres per litre, which results in a lower tax contribution throughout a vehicle's lifetime (Potter 2009). Recognising the estimated future running costs of a vehicle at the time of purchase may further influence vehicle choice (Giblin, McNabola 2009; Hayashi *et al.* 2001). However, there is little empirical evidence on how fuel costs can influence car purchasing decisions.

1. Background to Research

1.1. Overview of the Chinese Taxation System

China is now the largest car market in the world due to a combination of rising private income and associated car ownership (Zhu *et al.* 2012). In attempt to minimise the negative effects of this rising car ownership, the Chinese government has recently introduced a range of policies, including taxation measures to encourage consumers to purchase LEVs (Qian, Soopramanien 2011). At the time of this research, four main taxation-based measures were in place in China, namely:

– VAT at a flat rate of 17%, payable at the time of purchase;
– fuel duty at 15% for gasoline, although, is reduced for some greener fuels;
– a vehicle purchase tax at 10%, payable at the point of sale;
– following the 2012 Vehicle and Vessel Tax annual motor tax ranges from between 60 to 5400 ¥ based on the cylinder capacity of cars.

1.2. Models Proposed to Understand Individuals' Car Purchasing Decisions

A number of behavioural models have been proposed to help explain individuals' car purchasing decisions (see Nayum *et al.* 2013 for a review). Earlier models have traditionally focused upon aspects such as vehicle attributes (including fuel efficiency, performance and financial considerations) and the characteristics of the household and principal driver/owner (e.g. Sprei, Wickelgren 2011). Later models have since been expanded to include aspects such as attitudes, personality and lifestyle choices (e.g. Turrentine, Kurani 2007) and more recently psychological aspects (e.g. Zhu *et al.* 2012).

Further, the majority of car purchasing models focus on predicting car size classes (e.g. Choo, Mokhtarian 2004). This makes them difficult in being able to predict LEV purchasing choices as key factors such as engine size and fuel type differ within as well as between car size classes (Nayum *et al.* 2013).

One of the more recent models suggested (Lane, Potter 2007) highlights the multifaceted nature of vehicle purchasing decisions, including situational and psychological factors influencing the decision-making process and the role of feedback in reinforcing or rejecting past decisions (Fig. 1):

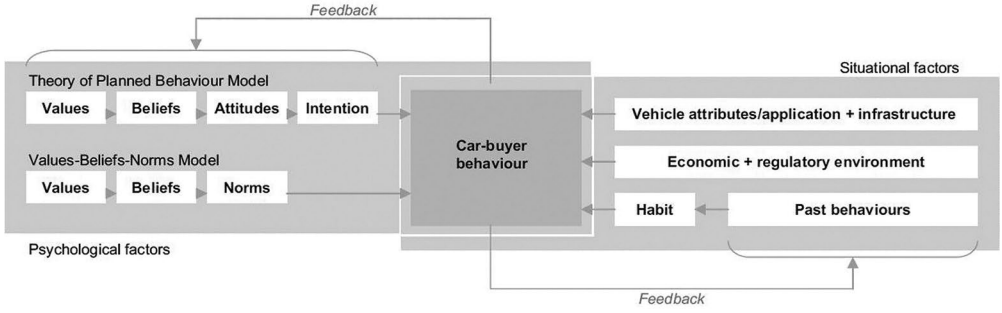

Fig. 1. Lane and Potter's (2007) model of individuals' car purchasing decisions

– ***situational factors:*** are concerned with the social conditions and physical structures present, including the economic and regulatory environment (including taxation), vehicle attributes and existing fuel costs and refuelling infrastructure. Past behaviour and habits are also classed as situational;
– ***psychological factors:*** are related to individuals' attitudes, perceptions, beliefs, values and norms. These subjective factors make some individuals more predisposed to pro-environmental behaviours (Bamberg *et al.* 2011) which in the case of this research concerns future LEV purchases.

Whilst the model suggests a straightforward distinction between the two types of factors, a cause-and-effect relationship may be present where situational factors (including vehicle taxation) can indirectly alter psychological standing, i.e. by changing attitudes and preferences towards LEVs.

1.3. Research Aims

In order to better understand individuals' vehicle purchasing decisions, this research aims to explore the relative importance and relationship between psychological and situational factors, particularly the role of 'green' taxation measures on individuals' future vehicle purchasing decisions. In addition, we aimed to explore how current Chinese taxation measures could be adapted, and future measures introduced to facilitate the uptake of LEV's among future Chinese drivers.

1.4. Methodology

Students attending the Dalian University of Technology (China) were invited to complete an online questionnaire[1]. The student population was selected as they are a known population group with a strong desire to own a car and are more likely to be able to afford a car in the future, than other population groups (Zhu *et al.* 2012).

The questionnaire asked respondents some basic socio-demographic questions (age and gender), and asked them to rate:

– the relative importance of 29 situational factors identified via previous research (including King, 2007; Turrentine, Kurani 2007) on future vehicle purchasing decisions which were measured on 7-point Likert scales (1 = Not important to 7 = Very important) – see Table 1;
– the strength of 11 psychological constructs relating to the purchase of a LEV, based on current understanding of individuals' pro-environmental decision-making behaviour (i.e. The Stage Model of Behavioural Change – Bamberg 2013). Each construct was measured via attitude statements on 7-point Likert scales (1 = Strongly disagree to 7 = Strongly agree) – see Fig. 2 and Table 1;
– the potential influence of 10 policy measures on future LEV purchasing decisions, either as a suggested modification or addition to current Chinese policy and measured on 7-point Likert scales (1 = Not influential to 7 = Very influential) – see Table 4.

Respondents were also provided on a definition of LEV's, which for the purposes of this research were cars with a 2 L capacity or less, and example car models (LEV's or not) provided.

2. Sample and Analysis

In total 342 usable questionnaires were returned. Participants were all non-car-drivers, aged between 16–44 years (average age 27), 168 of whom were male and 174 female.

2.1. Segmentation of Sample

It is increasingly recognised that any population is made up of individuals with varying levels of susceptibility towards changing their behaviour (e.g. Beirão, Cabral 2008; Bamberg *et al.* 2011). The influence of taxation and other policy measures upon car purchasing decisions will thus also vary within populations and needs to be accounted for in future policy decisions in order

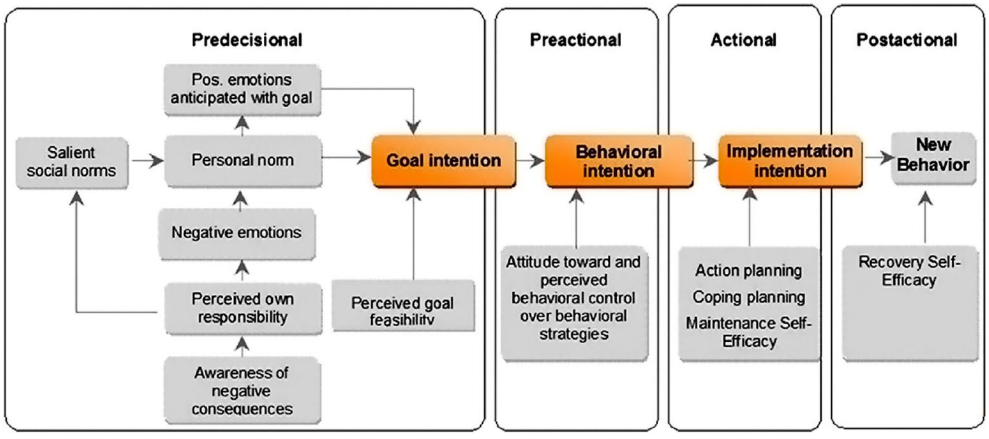

Fig. 2. The Stage Model of Behavioural Change (Bamberg 2013)

[1] Dalian University of Technology is located in the coastal city of Dalian, in northeastern China's Liaoning Province. Approximately 3000 academic staff work at the university and over 40000 students are enrolled on various full-time undergraduate and postgraduate courses.

to optimise their effects (Anable 2005). To examine these differences we employed a form of segmentation: K-Means Cluster Analysis a statistical procedure which essentially entails defining meaningful sub-groups of individuals into a manageable number of groups that are mutually exclusive and share well defined characteristics (Hair *et al.* 1998). In this instance, these characteristics were the importance attached to both situational and psychological factors on future LEV purchase decisions.

This analysis revealed three distinct segments, subsequently named Pro-Greens, Maybe-Greens and No-Greens. The distribution of the three segments within the sample is given:

- ***Pro-Greens*** (33.6% of total sample);
- ***Maybe-Greens*** (20.2%);
- ***No-Greens*** (46.2%).

2.2. The Importance of Situational Factors and Construct Strength

To explore significant differences between the segments regarding the importance and strength of each factor/construct on future vehicle purchasing decisions, a series of One-way ANOVAs were performed, followed by post-hoc Scheffe tests.

Table 1 presents the mean scores for both situational factors and psychological constructs for each segment, ranked in order of those items most influencing intentions for future vehicle purchasing decisions.

The situational factors measured were: Insurance group (IGp), Maintenance costs (MCs), Vehicle warranty (VWy), Road tax (RTx), Trade-in-value (TiV), Vehicle model (VMl), Make of vehicle (VMk), Exterior vehicle size (VSz), Vehicle style/appearance (VSy), Security features (SeF), Safety features (SaF), Equipment levels (EQp), Entertainment features (ENt), Acceleration time (ACt), CO_2 emissions (CO_2), Other emissions (EmO), Vehicle noise (VNo), Fuel consumption (FuC), Fuel type (FuT), Fuel economy (FuE), Performance /drivability (PFm), Engine type/size (ESz), Luggage/storage space (SSp), Vehicle/Passenger capacity (VCy), Vehicle body shape (VBs), Vehicle price (VPr), VAT (VAT), Value for money (VfM); Finance options (FNc).

The psychological constructs (shaded in grey in Table 1) measured were: Behavioural Intention (BIn); Goal Intention (GIn); Perceived Behavioural Control (PBC); Personal norms (PNm); Personal Responsibility (PRy); Social Norms (SNm); Goal feasibility (GFy); Consequences of behaviour (CQs); Negative effect (NEf); Attitudes (ATt); Emotions (EMs).

As shown in Table 1, Pro-Greens are significantly more prepared psychologically than both other segments to purchase a LEV in the future. They indicated a significantly greater intention to purchase a LEV in the future, hold significantly more positive attitudes towards LEV's, indicate a significantly greater sense of personal responsibility and personal/social duty to purchase a LEV, are significantly more aware of the negative effects of not reducing the environmental impacts of car driving, would feel significantly worse if they did not buy a LEV/significantly more positive if they did, and indicated it would be significantly easier for them to purchase a LEV, than both other segments.

They also attach significantly greater importance to the level of emissions and noise emitted, fuel consumption, fuel type and fuel economy in future car purchases than both other segments.

In contrast, No-Greens attach significantly greater importance to the performance, acceleration, make, style and entertainment features to both other segments, and also significantly greater importance to engine size, vehicle size, vehicle price, security features, equipment levels and storage space compared to Pro-Greens.

The level of importance attached to various factors and psychological preparedness of Maybe-Greens, tend to fall somewhere in the middle of the other two segments. They did score significantly higher on some psychological constructs (behavioural intention, personal and social norm, PBC, attitudes and consequences of behaviours), and fuel consumption compared to No-Greens, and also scored significantly higher on some situational factors engine size, vehicle body shape, model, style and shape, equipment levels), than Pro-Greens.

Overall, financial aspects (VfM – value for money; VPr – vehicle price; MC's – maintenance costs; FuC – fuel consumption and IGp – insurance group) were identified as relatively important aspects (in the top 10 aspects). With the exception of value for money (ranked in the top 10 for all segments), the importance of financial aspects varied between segments, with Maybe-Greens generally attaching greater importance than the other two segments, with the exception of maintenance costs where No Greens attached significantly importance than both other segments.

Looking specifically at the two taxation measures overall (highlighted by bold borders), VAT was ranked 8th most important, and Annual Road Tax 19th. However, this ranking of importance was shown to differ between segments, with VAT ranked 6th for Maybe-Greens, 9th for No-Greens, but 24th for Pro-Greens. Similarly, Annual Road Tax was ranked 5th for Maybe-Greens, 23rd for Pro-Greens and 28th for No-Greens. This suggests that purchases taxes (VAT) are more influential in shaping car purchasing decisions, than circulation or road fuel taxes (Potter *et al.* 2005).

Whilst no direct measure of fuel cost was included in the assessment, proxy measures of this aspect, namely, fuel consumption was ranked 9th overall, although, fuel type was ranked 22nd and fuel economy 26th. Pro-Greens attached significantly greater importance to fuel consumption, fuel type and fuel economy to both other segments, which perhaps is more reflective of their overall green credentials, rather than attitudes towards cost issues.

2.3. Adaptation of Current Taxation Measures

Respondents were also asked to indicate on theoretical-based scales, whether a decrease (incentive for LEV purchase) in the current level of taxation measures would incentivise them or not, to purchase a LEV in the future. For those who indicated yes (84% of sample), they

Table 1. Importance attached to situational factors and construct strength / by segment

All	Pro-Greens	Maybe-Greens	No-Greens
VfM (6.19)	BIn (6.39) [2, 3]	VfM (6.07)	PFm (6.35)[1, 2]
PFm (6.01)	GIn (6.33) [2, 3]	PFm (5.88)	VPr (6.22) [1]
VPr (5.99)	EMs (6.31) [2, 3]	SeF (5.8)	MCs (6.01)[1, 2]
VWy (5.87)	FNc (6.25)	VPr (5.77)	SeF (5.93)[1]
MCs (5.7)	VfM (6.18)	RTx[3] (5.64)	VWy (5.87)[1, 2]
SeF (5.63)	FuC (6.08)[2, 3]	VAT (5.58)	ACt (5.78)[1, 2]
SaF (5.59)	PNm (6.06) [2, 3]	SaF (5.55)	ESz (5.72)[1]
VAT (5.58)	FuE (6.04) [2, 3]	VWy (5.42)	VBs (5.71)[1, 2]
FuC (5.52)	EmO (6.01) [2, 3]	IGp (5.41)	VAT (5.67)
IGp (5.49)	CO_2 (5.98)[2, 3]	FNc (5.38)	VfM (5.66)
ESz (5.38)	SNm (5.95)[2, 3]	ESz (5.3)[1]	VMk (5.66)[1, 2]
ACt (5.34)	VNo (5.84) [2, 3]	FuC (5.26)[3]	VSy (5.65)[1, 2]
FNc (5.32)	VPr (5.79)	VBs (5.16)[1]	EQp (5.49)[1]
VMk (5.19)	ATt (5.79) [2, 3]	ACt (5.14)	SaF (5.47)
VBs (5.17)	GFy (5.74) [2, 3]	VMk (5.14)[1]	IGp (5.39)
EQp (5.1)	CQs (5.74)[2, 3]	CQs (5.13)[3]	VCy (5.32)[1, 2]
EmO (5.08)	PBC (5.7)[2, 3]	EQp (5.13)[1]	VSz (5.32)[1]
CQs (5.06)	IGp (5.69)	VMl (5.06)[1]	VMl (5.28)[1]
RTx (5.05)	SaF (5.64)	MCs (5.04)	FNc (5.27)
CO_2 (5.05)	MCs (5.68)	FuT (4.96)	FuC (5.23)
VNo (5.04)	VWy (5.63	BIn (4.93)[3]	TiV (5.09)
FuT (5.03)	PFm (5.6)	VSz (4.9)[1]	ENt (5.03)[1, 2]
VSy (4.99)	RTx (5.47)[3]	PNm (4.86)[3]	FuT (4.7)
TiV (4.96)	VAT (5.44)	VSy (4.83)[1]	EmO (4.61)
VCy (4.94)	FuT (5.34) [2, 3]	TiV (4.8)	VNo (4.59)
FuE (4.88)	PRy (5.33)[2, 3]	VNo (4.75)	CQs (4.53)
VSz (4.87)	VMl (5.32)	SNm (4.7)[3]	CO_2 (4.53)
VMl (4.85)	NEf (5.31)[2, 3]	VCy (4.7)	RTx (4.49)
ENt (4.7)	SeF (5.26)	CO_2 (4.67)	FuC (4.19)
SNm (4.62)	ESz (4.95)	GFy (4.61)	SNm (3.61)
GFy (4.45)	TiV (4.88)	GIn (4.59)	GFy (3.44)
BIn (4.52)	ACt (4.83)	EmO (4.58)	EMs (3.01)
EMs (4.44)	VMk (4.56)	EMs (4.57)	PBC (2.99)
NEf (4.31)	VCy (4.56)	FuC (4.52)	BIn (2.97)
GIn (4.31)	EQp (4.55)	ENt (4.45)	NEf (2.93)
PNm (4.22)	VBs (4.44)	PBC (4.32)[3]	ATt (2.85)
PBC (4.17)	ENt (4.38)	NEf (4.16)	GIn (2.72)
ATt (4.07)	VSz (4.23)	PRy (4.1)	PRy (2.69)
PRy (3.86)	VSy (4.17)	ATt (3.99)[3]	PNm (2.61)

Note: Superscript ([1, 2, 3]) indicates significantly greater differences relative to the other population segments ($p < 005$). Mean psychological construct strength are highlighted in *grey* and taxation measures with *bold borders*.

were then asked to indicate the percentage decrease that would:

- ***make them think about a LEV purchase*** (reflective of The Stage Model of Behavioural Change Predecisional stage);
- ***seriously think about a LEV purchase*** (Preactional/Actional stages);
- ***definitely buy a LEV*** (Postactional stage).

2.3.1. Impacts of Changes in VAT Rate

As shown in Table 2, 25.5% of respondents would start thinking about purchasing a LEV if current levels of VAT were lowered by 3% and 60.7% if it was lowered by 17% (i.e. no VAT). 8.3% of respondents would seriously think about buying a LEV if VAT was reduced by 3% and 43.3% if it was lowered by 17%. 0.7% of respondents would definitely buy a LEV if VAT was reduced by 3% and 19.1% if VAT was abolished.

Table 2. Impact of changes in current level of VAT / by segment

Impact / segment	VAT						
	% decrease in VAT / % sample agreeing						% no amount
	–3	–6	–9	–12	–15	–17	
				Start think			
All	25.5	17.5	9	5.2	0.5	3	39.3
Pro-Greens	38	22	18	4	–	2	16
Maybe-Greens	22	18	10	10	4	2	34
No-Greens	18	14	2	4	–	4	58
				Seriously think			
All	8.3	5.6	4.9	6.4	12.3	5.8	56.7
Pro-Greens	20	12	8	10	26	4	20
Maybe-Greens	8	8	4	8	4	4	64
No-Greens	–	–	3	3	6	8	80
				Definitely buy			
All	0.7	0.7	1.3	1.5	5.7	9.2	80.9
Pro-Greens	2	2	4	2	8	18	64
Maybe-Greens	–	–	–	4	6	2	88
No-Greens	–	–	–	–	4	6	90

When looking at the individual segments, 38% of Pro-Greens, 22% of Maybe-Greens and 18% of No-Greens would start thinking about buying a LEV if VAT was reduced by 3%, and 84% of Pro-Greens, 66% of Maybe-Greens and 42% of No-Greens indicated they would start thinking about buying a LEV if VAT was abolished. 20% of Pro-Greens, 8% of Maybe-Greens but no No-Greens indicated they would seriously think about buying a LEV if VAT was reduced by 3%, and 80% of Pro-Greens, 36% of Maybe-Greens and 20% of No-Greens if VAT was abolished.

2% of Pro-Greens, although, no Maybe-Greens nor No-Greens indicated they would definitely buy a LEV if VAT was reduced by 3%, and 36% of Pro-Greens, 12% of Maybe-Greens and 10% of No-Greens indicated they would definitely buy a LEV if VAT was abolished.

2.3.2. Impacts of Changes in Fuel Duty Rate

As shown in Table 3, 26.1% of respondents would start thinking about purchasing a LEV if current levels of fuel duty were lowered by 3%, and 69.1% if it was lowered by 15% (i.e. no duty). 10.5% of respondents would seriously think about buying a LEV if fuel duty was reduced by 3%, and 55.4% if it was abolished However, no respondents indicated they would definitely buy a LEV if fuel duty was reduced by 3% although, 23.3% would if fuel duty was abolished.

When looking at the individual segments, 44% of Pro-Greens, 24% of Maybe-Greens and 14% of No-Greens would start thinking about buying a LEV if fuel duty was reduced by 3%, and 88% of Pro-Greens, 72% of Maybe-Greens and 54% of No-Greens indicated they would start thinking about buying a LEV if fuel duty was abolished. 24% of Pro-Greens, 12% of Maybe-Greens but no No-Greens indicated they would seriously think about buying a LEV if fuel duty was reduced by 3%, and 84% of Pro-Greens, 52% of Maybe-Greens and 36% of No-Greens if fuel duty was abolished

No Pro-Greens, Maybe-Greens or No-Greens indicated they would definitely buy a LEV if fuel duty was reduced by 3%, although, 40% of Pro-Greens, 22% of Maybe-Greens and 12% of No-Greens would definitely buy a LEV if fuel duty was abolished.

3. Potential of Future Policy Measures

To explore the effect of potential policy measures on future vehicle purchasing decisions, respondents were also presented with 10 suggested policy measures that would provide either financial or time-savings for LEVs (Table 4), namely:

- RTx: annual motor vehicle tax derived by a fixed monetary amount (¥) per g/km of CO_2;
- REB: rebates for vehicles below a CO_2 emissions threshold;
- FEES: fees for vehicles above a CO_2 emissions threshold;
- VAT: VAT based on CO_2 emissions;
- SCP: scrappage allowance with an emissions limit on the replacement vehicle;
- PARK: parking charges based on CO_2 emissions;
- INS: motor insurance premiums partly based on CO_2 emissions;
- LEVL: designated 'low emission vehicle lane';
- RUFL: a road user charging scheme with a flat rate payment charge according to CO_2 emissions of vehicles;
- RUKM: a road user charging scheme with payment based on kilometres travelled according to CO_2 emissions of vehicles.

Table 3. Impact of changes in current level of Fuel duty / by segment

Impact / segment	Fuel duty					
	% decrease in Fuel duty / % sample agreeing					% no amount
	–3	–6	–9	–12	–15	
			Start think			
All	26.1	18.8	9.8	7.9	6.5	30.9
Pro-Greens	44	18	16	4	6	12
Maybe-Greens	24	22	8	14	4	28
No-Greens	14	18	6	8	8	46
			Seriously think			
All	10.5	9.2	9.6	11	15.1	44.6
Pro-Greens	24	10	14	16	20	16
Maybe-Greens	12	6	6	14	14	48
No-Greens	–	10	8	6	12	64
			Definitely buy			
All	0	1.3	2.8	4.8	14.4	76.7
Pro-Greens	–	4	6	8	22	60
Maybe-Greens	–	–	4	6	12	78
No-Greens	–	–	–	2	10	88

As shown in Table 4, overall, fees, rebates, and a road-user charging scheme based on distance travelled were identified as the top three influential measures to incentivise LEV purchases, closely followed by VAT, annual road tax and insurance premiums.

When looking at individual segments, Pro-Greens indicated they would be significantly more influenced by all measures than the No-Greens, and significantly more influenced by all measures, with the exception of VAT and low emission vehicle lanes than the Maybe-Greens. Maybe-Greens would be significantly greater influenced by VAT, low emission vehicle lanes and a scrappage scheme than No-Greens.

There were also notable differences in the rank ordering of measures between segments. Whilst all three segments rated fees, rebates and a distance-based road-user charging scheme in the top five most influential measures, Pro-Greens also rates insurance premiums and parking charges in the top five, Maybe-Greens VAT and low emission vehicle lane, and No-Greens VAT and annual motor vehicle tax.

Conclusions

Three distinct population segments were identified based on their psychological readiness and importance attached to situational factors for future LEV purchases.

Pro-Greens are more psychologically prepared than the other two segments to purchase a LEV, are more likely to be influenced by changes in current taxation measures in place and any future measures that would incentivise LEV purchases and use.

Table 4. Influence of future policy measures / by segment

All	Pro-Greens (1)	Maybe-Greens (2)	No-Greens (3)
FEES (5.11)	RUKM (6.13)$^{2, 3}$	VAT (5.09)^{3}	FEES (4.65)
REB (4.99)	REB (5.9)$^{2, 3}$	FEES(4.97)	VAT (4.51)
RUKM (4.95)	INS (5.88)$^{2, 3}$	LEVL (4.67)^{3}	REB (4.47)
VAT (4.86)	FEES (5.83)$^{2, 3}$	REB (4.65)	RTx (4.37)
RTx (4.66)	PARK (5.3)$^{2, 3}$	RUKM (4.51)	RUKM (4.29)
INS(4.63)	RUFL (5.28)$^{2, 3}$	RTx (4.45)	RUFL (4.16)
RUFL (4.59)	SCP (5.25)$^{2, 3}$	RCFL (4.43)	INS (3.97)
PARK (4.43)	VAT (5.2)^{3}	SCP (4.36)^{3}	LEVL(3.95)
SCP (4.33)	RTx (5.18)$^{2, 3}$	PARK(4.13)	PARK (3.94)
LEVL (4.28)	LEVL (4.5)^{3}	IP (4.06)	SCP (3.65)

Note: Superscript items ($^{1, 2, 3}$) indicate those significantly greater relative to the other population segments ($p < 0.05$).

No-Greens, and to a lesser extent, Maybe-Greens are less psychologically prepared than Pro-Greens, and their future car purchasing decisions appear to be driven more by situational aspects (vehicle performance, appearance and style, equipment etc.), and would also be less susceptible to changes in current measures, or the introduction of new LEV-incentivisation measures.

Perhaps the key question is how to 'push' the Maybe-greens and No-Greens into this psychological position of preparedness. Given their relatively low scores on key construct strengths, there are two possibilities. Firstly, psychologically-based awareness raising and information campaigns could be implemented (Bamberg 2013). These could aim to change current attitudes towards LEV's, instil confidence in LEV purchases (PBC, Goal feasibility), highlight the negative effects of car use, and promote the environmental benefits of LEV's to help change and shape personal and social norms. Further, as both these segments attach relatively high importance to cost issues (value for money, vehicle price) campaigners should highlight the potential long-term costs savings in fuel duty and annual road tax, currently available in China for LEV owners.

There does appear to be some scope to adapt current taxation measures in place, i.e. if they were lowered to incentivise LEV purchase. However, for any real significant changes in future buying choices, both VAT and Fuel duty would have to be completely abolished for LEV users, more so for No-Green and to a lesser extent, Maybe-Green population segments. Given that fuel duty is already graduated according to fuel type, these finding highlight the potential effects of this measure, although, further reductions for LEV users may be required. In relation to VAT, a similar system to fuel duty incentivise LEV is needed.

In terms of future measures to incentivise LEV purchases and use, the introduction of a feebate system, a CO_2 emissions VAT system, a distance based user charging scheme and annual road tax based on CO_2 emissions would appear to have the greatest potential overall. The finding in relation to feebates is consistent with findings in the US (Gallagher, Muehlegger 2011) and in parts of Europe (D'Haultfoeuille *et al.* 2014). This is encouraging as China has recently introduced a feebate system, whereby buyers of LEV's (cars with 1.6 ltr engines or lower) can receive a 3000 ¥ rebate. Taking into account the graduated system of annual road tax, these two measures combined are likely to achieve notable results. In relation to VAT, the current flat rate of 17% will need to be modified to further incentivise LEV purchases, and ultimately a distance-based road user charging scheme introduced.

Overall, the results obtained here do support the general assumptions of Lane and Potter's (2007) model, although, based on our results several weakness are currently present, namely:

- the model assumes an equal weighting of situational factors and psychological aspects;
- all categories of situational factors are assumed to have equal weighting;
- its presents a one-size-fits-all conceptualization of vehicle purchases for the general population;
- advances in understanding pro-environmental decision making have been made beyond the two models (Theory of Planned Behaviour and Value-Beliefs-Norms Model) suggested by Lane and Potter (2007).

Firstly, as shown in this research, the importance attached to both situational and psychological aspects, varies, often significantly, within different population segments. Similarly, differences, in the level of importance to the different types of situational factors were observed in his study, and sometimes significant differences between the different segments. It should be noted due to the nature of our sample (i.e. future drivers) we did not explore the role of habits in this study, which for other samples (i.e. actual drivers) aspects such as current car type and brand loyalty are likely to be important aspect in next-car purchase decisions (Brand *et al.* 2013). Taken the above findings together, the models assumptions cannot be applied to whole populations, and must be adapted to different population segments. Finally, as shown here, and consistent with current understanding of individuals' pro-environmental choices (Bamberg 2013), more psychological constructs need to be included within the model, specifically emotions associated with the type of car purchased, and the feasibility for individuals to make a LEV purchase.

Whilst there are limitations about the ability to generalise these results (sample size and sample) the results have provided an insight into how the current Chinese taxation system could be optimised, the potential of future taxation measures, and how these are likely to impact on different population segments decisions to purchase LEV's, or not. Specifically, there is a need to sample other population segments (i.e. non-students and actual car drivers), as well as larger samples, in order to fully understand both the relationship between psychological and situational factors in determining individual Chinese car LEV purchasing decisions. Future surveys are planned to address this issue, in various locations in China with actual car drivers.

In summary, based on these results, we can conclude that green taxation measures have strong potential to shape future Chinese car drivers decisions to purchase (or not) LEV's, although, adaptations to the levels of incentives for LEV's within the current taxation system are required to further incentivise LEV purchases.

Acknowledgements

The authors wish thank the support for this research from Lloyd's Register Foundation (LRF), who helps to protect life and property by supporting engineering-related education, public engagement and the application of research.

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