CAR OWNERSHIP PERCEPTIONS AND INTENTIONS AMONGST SOUTH AFRICAN STUDENTS

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ABSTRACT

High levels of car ownership have major impacts on congestion and thus the mobility, accessibility, heath and liveability in cities. Increasing car ownership is already reflected in high congestion levels in South African cities and does not appear to be reducing, despite policy interventions. The factors that drive the high car ownership intentions thus need to be investigated, so that policy efforts can be appropriately directed. The study aimed at investigating the car ownership intentions of students, as being most likely to drive car sales in the future, with the purpose of understanding the factors underlying the high desire to own a car. The study finds that although costs are the main barrier to market entry, and that most students intend to purchase a car as soon as they can afford it. These intentions are largely driven by the view that the quality of public transport constrains the movement of people and does not provide a travel alternative that is considered to be a reasonable alternative to the car, as indicated by the view that cars are a necessity. The study finds that although there are differences in the valuation of public and alternative modes of transport, based on demographic elements, familiarity with car usage and psychosocial factors, most students intend to own a car as the best means of travel, with little seeming to moderate the decision. The poor valuation of public and alternative transport suggests however that, whilst other measures to curb car use and promote public transport may have value, only significant service level improvements in public transport is likely to drive real behaviour change.

1. Introduction

It is often asserted that people, especially younger people, have a decreasing desire to drive and purchase cars. The popular press frequently refers to the concept of peak car ownership and the decline of car ownership in major metropolitan areas, such as London and Paris (The Wall Street Journal, 2015; Moss, 2015; Tuttle, 2015; Arquati, 2014; BBC news, 2014; Ross, 2014; Rosenthal, 2013 and London transport data, 2011). Although this appears to be true in some countries, Belgiawan, et al. (2014) assert that it is only in a limited range of developed countries. They considered car ownership motivations amongst students and found that there are significant discrepancies between students from developed and developing countries.

Although the World Bank indicates that car ownership figures in developing countries such as South Africa are considerably lower than developed countries such as the United States or the United

Kingdom, 165 per 1000 people, compared to 809 and 519 (The World Bank, 2016), the latest South African National Household Travel Survey (NHTS) (Statistics South Africa, 2014) indicates that the number of households in the country that own cars is approximately 28.3 percent, increasing significantly from 22.9 percent in 2003. This is reflected in total vehicle sales, which have risen, from an average of 30 000 per annum in 1996 to approximately 50 000 per annum in 2016 (Trading economics, 2016b). Although the growth has stabilised over the last five years; stability when GDP has effectively declined (Trading Economics, 2016a) provides some indication that car ownership intentions remain high amongst the general population.

High levels of car ownership are undesirable in urban areas. Although car ownership is popularly associated with higher levels of mobility, more frequently it results in high levels of congestion, urban sprawl, additional time spent in traffic, increasing pollution levels, high transport costs and resultantly, lower levels of mobility and accessibility, as well as decreases in the liveability of cities. It is therefore important, from a policy and planning perspective, to determine the factors that drive car ownership intentions, so that interventions can be designed to mitigate against rising ownership levels.

Johannesburg, the largest metropolitan area in South Africa, is ranked as the 77th (of 146) most congested city in the world (Tomtom, 2016). South African transport policies (Department of Transport, 2015; National Planning Commission, 2011; Department of Transport, 1996) prioritise public over private transport, however the above figures reflect that they have not been effective in reducing car ownership levels and these are thus likely to worsen over time.

Most of the growth in global car ownership is projected to take place in developing countries (Ecola, et al., 2014; Dargay, et al., 2007). Although much research has been done on car ownership around the world (Verma, 2015; Belgiawan, et al., 2014; Zhu, Zhu, Lu, He & Xia, 2012; Clark, 2009), very little has been done in Africa (Salon & Aligula, 2012), much less South Africa. Johannesburg, as the economic hub of South Africa, with the highest population density, is the city most likely to be affected by congestion and, as such, is appropriate for the review of car ownership intentions in the country. The aim of this work is to describe these intentions amongst students based at a major metropolitan university in Johannesburg. Based on research done by Zhu, et al. (2012), university students were chosen as the research population because of the relatively high possibility they had of being able to afford a car in the future (as well as their diverse demographics, ease in recruitment, and the ability to survey them in a controlled environment), thereby providing some indication of the motivations for the high levels of car ownership in the country.

2. Previous research

Existing research investigating car ownership intentions reveals that these differ considerably from country to country. Whilst literature from some developed countries generally tends to indicate a decline in car ownership, that from developing countries appears to reflect a growing desire to own a cars. Studies from developed countries such as Germany (Kuhnimhof, Buehler, Wirtz and Kalinowska; 2012) and the Netherlands (Oakil, Manting and Nijland; 2016) suggest that car use amongst young adults has decreased in recent decades.

Kuhnimhof, et al. (2012) asserted that the primary reason for the decrease has been the use of alternative modes of transport. Even in developed cities such as Dublin, where car ownership has slowed but is still increasing, McGoldrick and Caulfield (2015) found that the availability of public transport impacted car ownership levels. Sigurdardottir, Kaplan and Møller (2014) found three groups of intentions in Danish adolescents, i.e. early car users, who are car enthusiasts and have car-oriented networks; early licence holders and later car users who associate cars with high instrumental values, but view the expense as a barrier and late licence holders and car users, who are generally car sceptics, have a low interest in cars. Car sceptics tend to be from urban areas, whilst enthusiasts were less likely to reside in cities, implying that the availability of a public transport system impacts the ownership intention. Clark (2009) also asserted that location impacts car ownership. Regardless of whether ownership is increasing or decreasing, these studies showed that car ownership intentions were largely influenced by the location of the household (urban populations generally have better access to public transport) and the availability of alternatives. Higher levels of public transport is thus likely to reduce car ownership.

High car ownership intentions are not however only related to the relative lack of public transport services, but also to the quality of the public service offering. In one of the few publications that discusses car ownership in Africa, Salon and Aligula (2012) considered urban travel patterns in Nairobi, Kenya and reported growing car ownership. Although a large portion of the population could not afford to travel regularly, the middle income group who couldn't afford cars was almost completely dependent on the informal public transport system, which provided good coverage at low service levels. They found that without policies to improve public transport service, car use would increase as residents became wealthier. Wu, Zhao and Zhang (2016) indicated that the larger the city, the higher the levels of car ownership, unless the city controlled this through aspects such as the provision of excellent public transport. They further indicated that, in metropolises, an increase in the comfort levels of public transport was associated with a decrease in car ownership. Zhu, et al. (2012) showed that Chinese students valued aspects of car ownership such as comfort, transporting goods and saving time. Verma (2015) asserted that, in India, car use was growing exponentially and also largely attributed this to the lack of good public transport. The study found that cars were often considered

a safer method of transport. The study also highlighted other quality aspects as important determinants, such as the flexibility provided by cars, the lack of good public transport and shorter times associated with car trips. Oakil, et al. (2016) asserted that car ownership was declining in urban areas in the Netherlands, probably due to better accessibility to public transport, reducing time and place constraints and therefore implying a lower need to own cars. Anowar, Eluru and Miranda-Moreno's (2015) study in Canada also found that improvements in public transport services can reduce car ownership levels. These findings are supported by Kuhnimhof, et al. (2012) who showed that driving in urban areas has been actively discouraged by improvements in public transport services in many urban areas and McGoldrick and Caulfield (2015) who highlighted not just the availability of public transport that impacted car ownership intentions, but the level thereof. These findings suggest that the mere provision of public transport is insufficient to impact car ownership intentions, but that service levels should be of such a nature that public transport is considered as a viable alternative to the car. Aspects such as comfort, coverage, the ability to travel further and carry more items, safety, trip times, frequencies and the hours of service were highlighted in these studies. These findings also seem to indicate that these aspects have largely been recognized in some developed countries, where better public transport service levels have resulted in decreases in car ownership. Whilst some developing countries appear to recognise this (Zhu, et al., 2012), most of those reviewed have not provided sufficiently high levels of public transport to reduce car ownership intentions.

Associated with the provision of public transport is city structure. Oakil, et al. (2016), Wu, et al. (2016), McGoldrick and Caulfield (2015), Sigurdardottir, et al. (2014), Zhu, et al. (2012) and Clark (2009) all found that the density of the area impacts ownership levels, attributable to higher levels of public transport in bigger cities. This suggests that the provision of high levels of public transport services tends to be associated with high density urban areas, thus enabling lower levels of car ownership. This is not however true in some of the studies from developing countries, where cities had not developed higher levels of public transport services and rather provided car-centric infrastructure which was unfavourable to public transport users (Salon & Aligula, 2012; Verma, 2015). City structures therefore impact car ownership levels, in as far as they affect the ability to provide good public transport.

Given that many developing countries appear to be poorly serviced by public transport, the reviewed studies then suggest that the primary barrier to car ownership is income and as it increases, so too does car ownership. This is not only true in developing countries. Clark (2009) found this in the UK and Wales and Sigurdardottir, et al's. (2014) early licence holders and later car users were those that indicated that once a financial threshold had been reached, their intention was to purchase a car. Wu, Zhao and Zhang (2016) stated that the sharp increase in car ownership since 2000 was linked to an upward trend in the economy. Belgiawan, et al. (2014) found that income levels partially explained

purchase intentions in developed and developing countries. As previously noted, Salon and Aligula (2012) directly associated income with car ownership intentions and Kuhnimhof et al. (2012) also highlighted this association by suggesting that shifts in travel behaviour could largely be attributed to increased cost of driving and the decline in real income. Income levels thus appear to be a significant determinant of car ownership intentions, but must be seen in conjunction with the provision of public transport services; where these are at a relatively high level, the impact of income increases on car ownership intentions appears reduced.

Although car ownership intentions thus appear to be primarily influenced by the provision of good public transport and income levels, there are a number of other aspects that may influence the decision. Oakil, et al. (2016) and Clark (2009) identified household composition and Anowar, et al. (2015) suggested that socio-demographic variables were an important predictor of car ownership. Tilley & Houston (2016), Bastian & Börjesson (2015) and Stokes (2012), for example, all found differences in the travel patterns of men and women, while Lee & Scott, 2015, BAME, 2012 and Giuliano, 2003 all found that ethnicity impacted travel behaviour. Socio-economic features may also however be influenced by prevailing cultural aspects. Belgiawan, et al. (2014) recognised that aspects such as the symbolic value of the vehicle and independence had an effect. In contrast to other studies, they stated that attitudes regarding public transport were not highly correlated with purchase intentions, however the prevailing mobility culture did have an impact in some instances. Zhu, et al. (2012) showed that valuations that were important were cars as success symbols, individual control, necessity and modernity. Sigurdardottir, et al's (2014) early car users are car enthusiasts and were generally shown to have car-oriented networks. Finally, policy aspects may influence the car ownership intention. Kuhnimhof, et al. (2012) suggest that changes in the transport system were not only price related, but that driving in urban areas has been actively discouraged by transport policies, public transport improved its service in many urban areas and many German municipalities implemented measures that promote walking and cycling. Anowar, et al.'s (2015) reported that policies regarding public transport promotion and car ownership restrictions also impact ownership levels. Wu et al. (2016) indicated that car ownership would continue to increase, unless the city controls this through aspects such as licencing restrictions or the provision of excellent public transport. Salon and Aligula (2012) also highlight the importance of policies to improve public transport service.

The common feature in most studies appears to be that the provision of an excellent public transport system is critical to the reduction of car ownership intentions and where public transport is poor, many studies suggest that income levels are then the primary predictors of the decision. These approaches tend however to disregard the aspirational aspect of car ownership, particularly in developing

countries where car ownership is often seen as a necessity, the only viable alternative to poor public transport systems or a status symbol and purchase intentions may therefore exist regardless of income levels. There are vast differences in developed and developing country perspectives as well as among various developing countries, shaped by the state of public transport, socio-economic factors as well as mobility cultures. This suggests that every country needs to identify the factors underlying car ownership intentions in order to address them from a policy perspective. In South Africa public transport is generally regarded as being of a very poor quality. The NHTS (Statistics South Africa, 2014) states that less than 9% of households had not experienced transport problems, implying that 91% had experienced problems, and the majority of the issues were related to public transport, specifically travel time, cost, flexibility, safety, security and reliability. As this situation is undesirable, this paper therefore seeks to identify those issues that impact the increasing desire to own a private car in South Africa so that policy interventions can be sought.

3. Data and methods

Johannesburg is the largest metropolitan area in southern Africa (City Population, 2015). The University of Johannesburg (UJ) is the largest university in the city (Top Universities, 2015) and it was therefore considered as appropriate to collect data that would be relatively representative of the Johannesburg student population. There are approximately 50 000 students registered at UJ in any given year. Using a standard sample size calculator (Creative Research Systems, 2012) for a 95 percent confidence level with a 3 percent confidence interval, a sample of 1044 students was required to obtain a representative sample of the population. Participants were randomly selected and oversampling resulted in a sample size of 1075.

The survey instrument was designed based mainly on two previous works, namely Belgiawan, et al. (2014) and Zhu, et al. (2012). These were chosen based on their research into car ownership in developing countries, as well as for the incorporation of most of the elements highlighted in the literature review. As the literature revealed that the quantity and quality of public transport was important, various questions were included to test the perception of public transport compared to private transport. Further questions also tested perceptions regarding public transport, where students were requested to compare cars to their current main mode of transport. Although students could not be questioned on income levels, the importance of income as a determinant of the car ownership intention was tested by asking whether students intended to buy cars once they had the means and, indirectly, within the next 5 or 10 years. The latter question assumed that students would then be working and thus salaried. The literature also revealed that familiarity with car ownership, demographic characteristics and psychosocial valuations such as cars being status symbols, cars

providing independence, etc. were important and therefore also included. Following the draft of an initial survey instrument, a group interview was held, primarily with transportation academics, to determine the applicability of the survey instrument to South Africa and adapt the instrument to incorporate questions specific to local circumstances.

After initial testing, the survey instrument was adjusted and finally incorporated 40 questions in four sections on several broad topics including demographic characteristics, current transportation patterns, perceptions on the benefits of private cars and intentions of future car ownership and preferences for car ownership. Demographic aspects that were tested included gender, age group, ethnicity and place of residence (normally[1] and whilst studying). Other aspects identified as likely to impact perceptions of vehicle ownership included current main mode of travel to and from campus, whether the student currently regularly drove a car, whether their families owned cars, whether they had driver's licences and whether they intended to obtain a licence in the near future. Views on the benefits of and perceptions on car ownership were tested in 19 (of 40) questions on a five-point Likert-type scale, anchored from strongly disagree to strongly agree, and included an option for "Don't Know".

The survey instrument was a four-page self-administered paper-based questionnaire and was conducted over a three-week period in March 2015. To ensure the objectivity of the research, all respondents participated voluntarily and had the option to withdraw from the survey process at any stage. They were also informed of the confidentiality and anonymity of their responses. Data analysis was conducted using SPSS for Windows v23 and v24.

4. Results

The results are organised into three sections, a description of the demographic profile; the results of an exploratory factor analysis; and the differences in the results between various groups.

4.1 Description of the sample

The demographic profile of the sample provided an appropriate representation of the composition of students at the university and are shown in Table 1 below.

Table 1: Demographic profile of sample (n denoted in brackets)[2]

Gender	Population Group	Place of residence whilst studying

[1] Most students are only resident in Johannesburg for the duration of their studies. The question determined the type of area students regarded as "home".

[2] Data was not weighted as comparisons between many groups was sought and it was anticipated that weighting one set of groups may have compromised the ability to gain sufficient responses in another set of groups.

Male	49% (519)	Black	78% (834)	Johannesburg	92% (994)
Female	50% (543)	White	11% (114)	Other	8% (81)
		Asian	6% (66)		
Age profile		Coloured[3]	2% (26)	**Usual residence (home)**	
18-20y	57% (612)	Prefer not to say	3% (35)	City (urban)	46% (497)
21-22y	32% (346)			Town	37% (400)
23-24y	7% (79)			Village (in rural area)	5% (58)
over 25	2% (20)			Rural/tribal homeland	5% (50)
				Other/prefer not to say	7% (46)

As an indication of one of the motivations for car ownership, the main modes of transport currently used by the students was tested as well as familiarity with car ownership. These are shown in Table 2. When compared to the NHTS (Statistics South Africa, 2014:22), which considers the modes that learners in the Gauteng province (within which Johannesburg is situated) use, the high incidence of walking in this sample is partially explained by the large number of students living on or close to campus. The high level of bus patronage is also partially explained by the provision of a free bus service by UJ for between-campus travel.

Table 2: Mode use and driving characteristics

	Sample	**NHTS**	**Black**	**White**	**Asian**	**Coloured**
			Main mode of transport			
Walking	30%	12%	35%	1%	2%	21%
Cars	23%	25%	7%	93%	83%	54%
Buses	23%	11%	28%	0%	2%	13%
Minibus-taxi	15%	31%	18%	1%	6%	8%
Other/combinations	10%		11%	4%	8%	4%
			Driving characteristics			
Drive regularly	29%		17%	91%	62%	56%
Family owns car	82%		79%	99%	100%	89%
Have licence	35%		26%	92%	67%	46%
If no licence, intention to obtain in next 5 years	100%					

Notably, there are major differences between population groups in the use of modes as well as driving characteristics. The figures should be read with caution (there were far fewer white, Asian and coloured than black students in the sample), but provide some background as to students' car ownership intentions.

4.2 Exploratory factor analysis (EFA)

Nineteen items related to perceptions of the benefits and intentions of car ownership were tested in the survey. The Cronbach alpha value for the items was 0.826, which exceeds the recommended value

[3] Coloured is still an official race classification, according to the South African government

of 0.7, suggesting good internal consistency (Pallant, 2016). An EFA was performed in an attempt to summarise the number of factors which impact car ownership intentions into a more manageable set of components. The items were subjected to principle components analysis (PCA). Before performing this, the suitability of data for factor analysis was evaluated. An inspection of the correlation matrix showed that many coefficients had values of 0.3 and above. The Kaiser-Meyer-Olkin value was 0.835, higher than the recommended value of 0.6, and Bartlett's Test of Sphericity reached statistical significance (Beavers, et al., 2013), therefore supporting the factorability of the correlation matrix.

PCA revealed the presence of five components with eigenvalues exceeding 1, explaining 26%, 9.1%, 8.3%, 6.2% and 5.7% of the variance respectively. This is shown in Table 3.

Table 3: Initial factor analysis - total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.934	25.969	25.969	4.934	25.969	25.969	3.443
2	1.728	9.093	35.061	1.728	9.093	35.061	2.311
3	1.582	8.327	43.388	1.582	8.327	43.388	3.212
4	1.181	6.215	49.603	1.181	6.215	49.603	2.812
5	1.083	5.701	55.304	1.083	5.701	55.304	1.414
6	.973	5.121	60.425				
7	.914	4.812	65.237				
8	.811	4.269	69.505				
9	.777	4.090	73.596				
10	.744	3.916	77.512				
11	.670	3.526	81.038				
12	.602	3.169	84.207				
13	.588	3.094	87.301				
14	.506	2.663	89.964				
15	.465	2.445	92.409				
16	.418	2.201	94.610				
17	.395	2.082	96.692				
18	.334	1.757	98.449				
19	.295	1.551	100.000				

The scree plot however indicated a clear break after the fourth component. Based on Catell's scree test (Catell, 1966), it was decided that four components would be used for further investigation. This was supported by the results of a Parallel Analysis (Ledesma & Valero-Mora, 2007), which showed

four components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size.

Inspection of the communalities showed that two items, i.e. "I intend to own a car within the next 10 years" and "Using a private car is less environmentally friendly than using public transport" had low values, indicating that they did not fit well with the other items in their components. The pattern matrix also indicated that these items had low loadings on their components. Based on this, these two items were removed to improve the scale.

The four-component solution, with items removed, explained 54.82% of the variance, with Component 1 contributing 28.57%; Component 2, 10.1%; Component 3, 9.23% and Component 4 contributing 6.93%. The pattern and structure matrix for the four-factor solution is shown in Table 4.

Table 4: Pattern and Structure Matrix for PCA with Oblimin Rotation of Four Factor Solution

Item	Pattern Coefficients				Structure Coefficients				Communalities
	Component				Component				
	1	2	3	4	1	2	3	4	
Having a car will be necessary in the future	**.629**	-.170	.080	-.054	**.713**	-.392	.233	-.319	.551
Cars are a part of modern life	**.521**	-.081	.108	-.206	**.634**	-.306	.260	-.424	.471
When I have the financial means, I will buy a car	**.810**	.026	.016	.024	**.796**	-.224	.140	-.248	.635
I intend to own a car within the next 5 years	**.778**	.121	.019	-.036	**.756**	-.132	.132	-.280	.584
A private car will allow me to travel to more places I wish to go	.353	**-.631**	-.121	.011	.525	**-.713**	.067	-.204	.625
A private car will allow me to travel further	.202	**-.662**	-.120	-.142	.435	**-.728**	.085	-.313	.604
A private car will allow me to transport more items	-.082	**-.827**	.009	-.011	.180	**-.805**	.170	-.148	.654
A private car will allow me to transport more people	-.282	**-.773**	.211	.044	-.022	**-.721**	.314	-.061	.627
A private car will allow me to travel more comfortably	.353	**-.432**	-.075	-.107	.511	**-.548**	.099	-.294	.441
Using a private car is cheaper than using public transport	-.099	.003	**.593**	.005	-.003	-.088	**.574**	-.099	.340
I will need to have a car to get a job in the future	-.044	-.022	**.774**	-.058	.111	-.181	**.785**	-.229	.620
Using a private car is safer than using public transport	.042	.053	**.605**	-.094	.158	-.104	**.623**	-.239	.400
Using a private car is more convenient than using public transport	.282	-.210	**.324**	.050	.384	-.355	**.403**	-.163	.305
It will be important to have a driver's licence in order to get a job in the future	.210	.002	**.579**	.036	.294	-.176	**.605**	-.170	.406
A private car is a symbol of success in my life	-.084	.052	-.001	**-.877**	.197	-.094	.179	**-.838**	.713
A private car will make me feel more in control of my life	-.041	-.035	.013	**-.886**	.272	-.199	.220	**-.882**	.780
A private car will give me greater freedom / independence	.276	-.061	.125	**-.542**	.499	-.280	.310	**-.677**	.561

Note: major loadings for each item are bolded

The four components are described in Table 5.

Table 5: Four component groupings following EFA

Component 1 (α = 0.768)	**Component 2 (α = 0.771)**
Buy car as soon as financial means are available Own a car within the next 5 years Car will be necessary in the future Cars are a part of modern life	A private car allows: transport of more items transport of more people travel to further places travel to more places more comfortable travel
Component 3 (α = 0.608)[4]	**Component 4 (α = 0.742)**
Need a car to get a job in the future Cars are safer than public transport Cars are cheaper than public transport Important to have a driver's licence to get a job Cars are more convenient than public transport	Private cars give me more control of my life A private car is a symbol of success Cars give greater freedom/ independence

This implies that the car ownership decision is influenced mostly by 17 variables that can be represented by four latent factors:

1. Cars as a necessity / inevitability
2. Broader travel options
3. Job requirement / Perceptions of public transport
4. Independence

In an open-ended question, students were asked to provide the single biggest reason for buying or not buying a car in the next few years. Anecdotal evidence was provided which supported the findings of the factor analysis. Responses were grouped into themes and are illustrated in Figure 1.

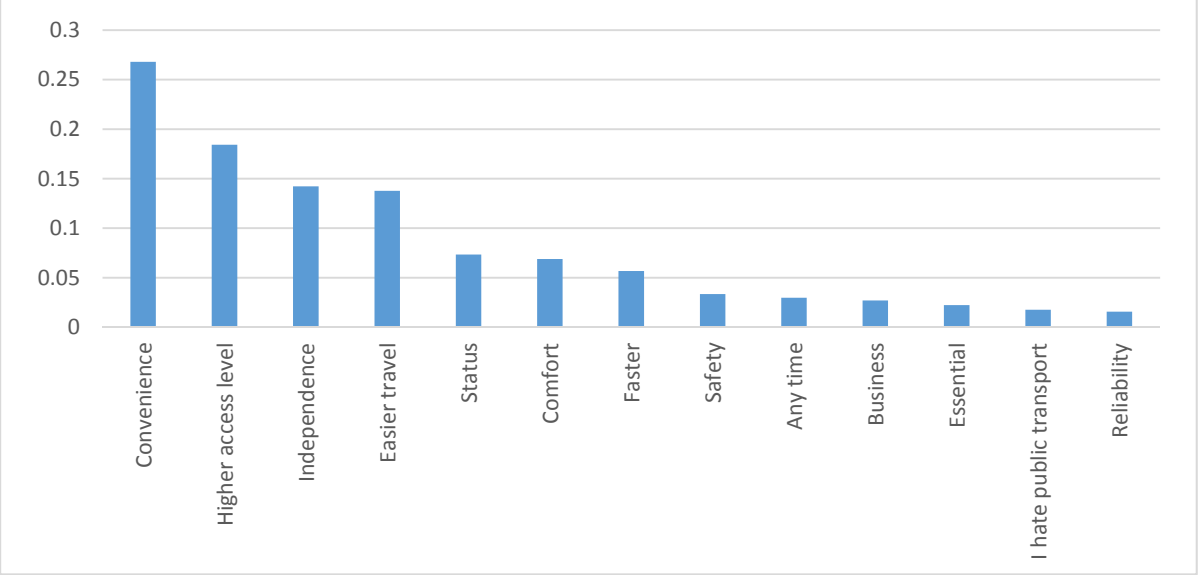

Figure 1: Main reason for purchasing a vehicle in the near future

[4] The slightly lower value is explained by the variety of items in the group.

4.3 Group differences

In general, the results reflect that car ownership intentions are extremely high for all students. As it is assumed that different backgrounds would result in different car ownership intentions, the four factors were tested to determine whether there were significant differences in the mean scores of the factors for different groups. The results of this analysis are shown in Tables 6 and 7.

Table 6: Tests of differences between groups within the sample (1)

	POPULATION GROUP			**GENDER**			**CURRENTLY DRIVE**			**FAMILY OWN CAR**		
TEST	Kruskal-Wallis; Mann-Whitney[5] with Bonferroni adjustment			Independent samples t-test			Independent samples t-test			Independent samples t-test		
H_0	Sig	Mean ranking	Effect size (r)	Sig	Mean diff. (Std error)	Effect size (Cohen's d)	Sig	Mean diff. (Std error)	Effect size (Cohen's d)	Sig	Mean diff. (Std error)	Effect size (Cohen's d)
The distribution of **Necessity** is the same across categories of …				✓	-0.15 (0.04)	0.22 S[6]				✓	0.14 (0.05)	0.20 S
The distribution of **Traveloptions** is the same across categories of …	✓	Black <Asian	0.12 S	✓	-0.09 (0.05)	0.12 Neg.	✓	0.16 (0.05)	0.22 S	✓	0.26 (0.06)	0.36 S/M
The distribution of **Publictpt** is the same across categories of …	✓	Black <Asian Black <White	0.16 S 0.14 S	✓	-0.11 (0.04)	0.16 S	✓	0.19 (0.05)	0.28 S/M	✓	0.24 (0.06)	0.36 S/M
The distribution of **Independence** is the same across categories of …				✓	-0.30 (0.06)	0.32 S				✓	0.24 (0.08)	0.31 S

Table 7: Tests of differences between groups within the sample (2)

	LICENCE			**HOME**			**MODES**		
TEST	Independent samples t-test			One way ANOVA			One way ANOVA		
H_0	Sig.	Mean diff. (Std error)	Effect size (Cohen's d)	Sig.	Differences	Effect size (Eta squared)	Sig.	Differences	Effect size (Eta squared)

[5] Mann-Whitney U test was used as one of the groups had a small sample size; some of the other groups had many severe outliers, and showed severity in skewness and kurtosis.

[6] Denotes size, neg.=negligible, S=small, M=Medium

The distribution of **Necessity** is the same across categories of …									
The distribution of **Traveloptions** is the same across categories of …	✓	0.20 (0.05)	0.28 S	✓	City & Rural area Town & Rural area Village & Rural area	0.02 S	✓	Taxi & Car Bus & Car Walking & Car	0.03 S
The distribution of **Publictpt** is the same across categories of …	✓	0.15 (0.04)	0.16 S	✓	City & Village City & Rural area	0.02 S	✓	Taxi & Car Bus & Car Walking & Car Bus & Walking	0.05M
The distribution of **Independence** is the same across categories of …				✓	City & Town				

Tables 6 and 7 indicate that significant differences exist between a number of the groups. From a population group perspective, for "Broader travel options" Asian students revealed a higher mean ranking than black students and for "Job requirement / Perceptions of public transport" both white and Asian students showed a higher mean ranking than black students. There were no real differences between white and Asian students. There are generally significant differences between men and women, with women showing higher means than men for all four components. Testing for differences in familiarity with car ownership (tested as whether the respondent currently drove, whether the family owns a car and whether the student had a licence) indicates that the more familiar with car ownership and use, the higher the valuation of all four of the components. The type of area which the students considered to be home also impacted their perceptions of car ownership. Considering "broader travel options", students from cities, towns and villages have higher means than those from villages. Students from cities indicate cars as having higher value than public transport than do their counterparts from villages and rural areas. The psychosocial aspects are valued also higher by students from cities than towns. Finally groups were compared based on the current mode of travel, to test whether particular modes influenced the car ownership intention. Those who used cars generally ranked cars as providing broader travel options and being better than public transport as higher than those who walked, took taxis or buses.

5. Discussion

The results of the EFA indicate that the car ownership intention is mostly influenced by 17 variables represented by four latent factors. The literature review suggests that, in developing countries, the desire to own a car is strongly linked to income or the ability to purchase a vehicle (Wu, et al., 2016; McGoldrick & Caulfield, 2015; Belgiawan, et al., 2014). This is also true for South African students, regardless of population group. The strong loading on component 1 (cars as necessity) suggests that

this is the primary driver of the high intentions of car ownership. The inclusion of two factors (Buy car as soon as financial means are available, Own a car within the next 5 years) indicates that income is certainly a strong predictor of car ownership intentions and supports the majority of the reviewed literature, which also indicated these as important determinants of car ownership intentions. This should however be interpreted together with the other three components. The second component, which describes the interpretation that cars allow broader travel options, suggests that students feel that available transport does not meet their travel requirements. The third component, that cars are better than public transport and that cars are a requirement to get a job, again suggests that public transport is not meeting the mobility, accessibility, safety and affordability needs of the students. The final component indicates that cars provide the status and independence that cannot be provided by public transport. Most of the studies reviewed, in both developing and developed countries, suggested that high car ownership intentions can be limited by the provision of appropriate public transport. That South African students view car purchase intentions as an inevitability can largely be ascribed to inadequate public transport service provision, as is evidenced by the loadings on the other three components. Supporting the findings of the literature review (Wu, et al., 2016; Verma, 2015; Salon & Aligula, 2012), these results indicate that mere provision of a public transport service is insufficient to drive behaviour change, and that public transport services should provide wider travel options and be sufficiently comfortable to provide a viable alternative to the car.

The results of the factor analysis are supported by the findings of an open ended question. This indicates, firstly, that students find it very difficult to travel. Convenience is the highest issue, suggesting that public transport does not offer expedient options. This is supported by the second most cited reason, i.e. higher access to travel, again suggesting that current access to travel options are limited. These are followed by independence, easier travel, status, comfort and faster travel. Aside from status, these results appear to reflect the general dissatisfaction with current travel options. From anecdotal evidence, students suggest that their mobility is constrained and that public transport is stressful. This is supported by four of the 19 questions which directly tested perceptions of cars in related to public transport and six of the questions which tested perceptions of cars in relation to current forms of transport. Generally, there appears to be a perception that public transport is unreliable, does not provide appropriate access, is uncomfortable, is time consuming and constrains movement. This is aligned the NHTS (Statistics South Africa, 2014) and Heyns and Luke (2017) who find general dissatisfaction with low service levels in public transport. These perceptions drive the idea that car ownership is the only viable solution to mobility needs.

When analysing the differences in the factors that motivate car ownership intentions across population groups, the factors that explained most of the variance is “Broader travel options” and

"Job requirement / Perceptions of public transport". The first compares their view of the benefits of cars over and above the alternatives (mainly public transport), whilst the second considers cars in relation to public transport and cars as a necessity within the working environment. Generally white and Asian students tend to value these two components higher than their black counterparts. Very few white and Asian students use public transport, as is evidenced by their responses on modal choice, and perceptions of public transport may therefore be skewed. They appear to perceive public transport as being of such poor quality that it is not a feasible alternative to the car at all. Black students are generally more familiar with public transport, but also do not find it to be a competitive car alternative. They do however indicate a better understanding that, although inadequate, public transport can be used to meet mobility requirements. Demographic features were identified in the literature review as potentially impacting car ownership intentions (Anowar, et al., 2015) and population group was tested in this study as being significant in the South African environment owing to past and current travel patterns. Although population group appears to have an impact on the valuation of two of the components identified in the EFA, these however appear to be related more to the familiarity with car ownership and the ability of the public transport system, rather than the population group per se.

Another demographic element that was tested was gender. Literature suggested that, in some developed countries, although men tend to drive more than women, women are catching up and car ownership intentions are sometimes stronger amongst women than men (Tilley & Houston, 2016; Bastian & Börjesson, 2015; Stokes, 2012). In South Africa, the NHTS (Statistics South Africa, 2014) indicates that more women have licences and are riving than ever before. Gender was therefore tested as anecdotal evidence from students suggested that there may be differences in intentions, as the quality of public transport was such that women did not feel safe on public transport due to personal security concerns. The results indicated that there were significant differences between men and women, with women showing higher means than men for all four components, affirming that the current state of public transport means that women feel more strongly that it is not a good travel option and the car is a preferable choice.

The literature indicated that familiarity with car ownership and its associated benefits, as well as individual mobility biographies, could also be predictors of the car ownership intention (Döring & Albrecht, 2014; Sigurdardottir, et al.,2014; Lazendorf, 2005). Students who currently drove regularly, who held licences and whose family owned cars were found to have higher mean rankings regarding the valuation of the car over the alternatives (specifically public transport) than those who didn't. This indicates that those who were more familiar with cars (and perhaps less familiar with public transport) valued the benefits provided by the car more highly, probably indicating either a lack of knowledge of

the service that is supplied by the public transport system or, having made the switch to cars, a preference for cars. The students that indicated that their family owned a car had higher means in all four factors, suggesting that familiarity with car usage implies higher value in all aspects, not only when comparing to alternatives, but also in psychosocial aspects.

The type of area which the students considered to be home also impacted their perceptions of car ownership, as was also found in a number of the reviewed studies. Considering "broader travel options", students from cities, towns and villages have higher means than those from villages, possibly as their travel needs are higher and they therefore require broader travel options. Students from cities indicate cars as having higher value than public transport than do their counterparts from villages and rural areas, most likely because of the higher need for travel. The psychosocial aspects are valued higher by students from cities than towns, most likely because the importance of status and independence tends to be higher in areas where wealth is more conspicuous and travel needs are higher.

Finally groups were compared based on the current mode of travel, to test whether particular modes influenced the car ownership intention. Those who used cars generally ranked cars as providing broader travel options and being better than public transport as higher than those who walked, took taxis or buses, again reflecting that the advantages appear larger to those who have cars than those who use public transport.

One of the key factors indicated in the results that, aside for a few cases, in general, there is very little difference between the groups for the highest loaded factor "Cars as a necessity/inevitability". This indicates that although demographic features, familiarity with car ownership, current modal choice and psychosocial valuations may impact car ownership intentions to some extent, the effect in most cases is small. This reinforces the finding that, although there are differences between various groups of respondents indicating slight differences in the impact of demographics and backgrounds on the car ownership intention, this does not reduce the intention to own a car. The highest loaded group, which incorporates tests on income (Buy car as soon as financial means are available, Own a car within the next 5 years) and on inevitability (A car will be necessary in the future, Cars are part of modern life) indicates that car ownership intentions amongst all students are very high and that income remains a strong predictor of the car ownership decision as does the feeling that car ownership is a necessity, clearly indicating that public transport is not a viable car alternative.

6. Conclusion

Because of the high impact on the environment and the liveability of cities, the costs and impacts of car ownership and congestion are the subject of scrutiny, globally and locally. Most of the growth in car ownership is projected to take place in developing countries (Ecola, et al., 2014; Dargay, et al., 2007). South African cities are now starting to reflect as some of the most congested cities in the world (TomTom, 2016). If car usage is not contained, it is likely that these cities will experience all the disadvantages commonly associated with congestion, such as constrained mobility and accessibility, higher travel costs, health effects and associated impacts on economic growth and development.

Despite these disadvantages, car ownership intentions remain very high in the country amongst young people. This appears to primarily be based on the perception that there is little better to provide mobility than a car. There are considerable differences in the factors that explain the variance between different groups of students however, whilst these appear to stem from familiarity with public transport systems, they do not fundamentally alter the desire to own a car. Those who already drive cars perceive car ownership to be the only reasonable means of mobility, with public transport not being considered as a practical alternative. Those who do not have cars perceive the public transport system as being so poor that they are intent on moving out of it into cars.

Understanding car use and car ownership intentions is critical to devising policies aimed at reducing car usage. Given that the desire to own a car in South Africa is largely fuelled by the failure of the public transport system (indicated from the loadings on factors 1-3), it is suggested that, if policy is to be effective, it be aimed at improving public transport services. Public transport should provide a reasonable alternative to the car.

There are a number of limitations to this study. As it was an exploratory analysis intended to measure perceptions and intentions, it is not possible to determine a model to describe the determinants of the car ownership intention. This would also be considered to be a possible direction for future work in this area. The study also noted differences between various groups, such as population, but did not control for factors such as household income, etc. These should be incorporated into future studies. Although the study finds that income remains the major factor impacting the car ownership decision, this appears to be largely attributable to the lack of viable alternatives. The extent to which improvements to the public transport system would impact the ownership intention is however not clear. Discrete choice modelling could be used in future studies to determine what levels of improvements would significantly impact the car ownership intention. This would be meaningful for policy makers and public transport service providers in determining appropriate public transport investment levels.

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