A META-ANALYSIS OF TWO GAUTENG STATED PREFERENCE DATA SETS

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ABSTRACT

Mode choice modelling is commonly done to estimate the patronage demand of the various available transport modes. Since the late 1990's in South Africa, Stated Preference (SP) surveys and occasionally Revealed Preference (RP) surveys have been used to estimate the representative trip utility attributes and their associated weightings. The transit utility attributes and weightings are also used in the transit assignment process. Two analysis techniques that are commonly used for this estimation are Conjoint Analysis (CA) and Discrete Choice Models (DCM). Given the theoretical and practical differences between the techniques, their results are expected to be different, which has implications for their use in forecasting. This paper compares conjoint-based and DCM models as well as derived measures of willingness to pay such as the Value of Travel Time Savings (VTTS) to provide insight into their relative applicability in the SA context. We do this by re-analysing two metropolitan SP data sets, undertaken in Tshwane (2010) and Ekurhuleni (2013), on which conjoint-based choice models were developed in multi-modal environments that included the private car, taxi, bus and train modes. In both cases the alternative mode was the proposed Bus Rapid Transit (BRT) systems that were being planned in these metros. The paper concludes that discrete choice based models are more appropriate for the estimation of mode choice behaviour.

1. INTRODUCTION

There can be numerous reasons for modelled (i.e. forecast) patronage demands differing from the realised demand. Shortcomings in the four-step transportation modelling process are widely recognised (Mladenovic & Trifunovic, 2012); (TRB Special Report 288, 2007). This paper argues that the lack of insight into traveller choice behaviour is a significant factor contributing to these disparities.

To motivate this contention, this paper presents the following:

- A review of the original conjoint-based SP questionnaires;
- Comparisons between the original public transport utility equations and those obtained with re-estimated conjoint-based and DCM models;
- DCM results of the consolidation of the two metro data sets;
- The resulting willingness-to-pay measures as quantified by the Value of Travel Time Savings (VTTS) that were different to those originally estimated.

Conclusions are drawn and recommendations made about best practice for the design of SP and RP surveys, as well as the selection and use of appropriate discrete choice models for mode choice simulation in South Africa metropolitan areas.

2. EXISTING TRANSPORTATION MODE CHOICE MODELS

Eight strategic multimodal transportation models were developed in South Africa between 2010 and 2014. Five of these were in Gauteng. These were for the metropolitan municipalities of Tshwane (2010), Ekurhuleni (2013), Johannesburg (2014), and two Gauteng Provincial models, i.e. a 2013 strategic model for the development of the Gauteng 25 Year Integrated Transport Masterplan, and a more detailed provincial model for the Gautrain Rapid Rail Extension Feasibility Study in 2014. The other models were developed by the City of Cape Town (2013) and the eThekwini Metropolitan Municipality (2013). This paper focuses on two metropolitan models in Gauteng, viz. Tshwane and Ekurhuleni.

For mode choice modelling, only the City of Johannesburg developed and applied more advanced Mixed Multinomial Logit (MML) models. The other metros estimated Multinomial Logit Models (MNL). In eThekwini, a car-ownership/car usage model was used to determine the primary mode split, i.e. between car and public transport. Transit assignment was used to estimate the secondary split between the various public modes.

Stated preference (SP) surveys were the source for collecting traveller behavioural data and the development of the choice models in the two metros under consideration. The SP sample sizes were relatively small when the number of modes are considered. However, they were considered adequate for the development of the choice models.

Table 1 is a summary of the SP surveys undertaken in Tshwane and Ekurhuleni. The highlights from the table are:

- Conjoint analysis was used as the basis for the development of the choice models in both metros;

- A five-point Likert scale was used to express user preference between their existing mode and the hypothetical BRT mode;

- Car out-of-pocket costs (i.e. petrol costs) were not included in the definition of the car trip utility. The walking time attribute was also not included for the public modes;

- While income data was gathered in the surveys, no income segmentation was applied in the estimation of the choice models, as this resulted in small sample sizes;

- The Alternative Specific Constant (ASC) was normalised for the existing mode (i.e. set to zero). The ASC is a relative value that captures the unobservable factors of utility of an alternative mode. These perceived factors commonly include mode comfort, safety and security, and reliability. The magnitude and sign of the ASC are important.

Table 1: Summary of Tshwane and Ekurhuleni Metropolitan Stated Preference (SP) Surveys

Metro	No. of SP Surveys per Mode / Income Group	Utility Attributes by Mode	SP Modes in Choice Sets	Choice Sets / Block	Base (Reference) Mode (ASC=0)
Ekurhuleni (2013) Total Surveys: 400	Car: 133	Waiting time In-vehicle time Fare[1] No. of transfers	Car BRT	20 (Likert 5 Pt scale)	Car
	Taxi: 133		Taxi BRT	20 (Likert 5 Pt Scale)	Taxi
	Train: 134		Train BRT	20 (Likert 5 Pt Scale)	Train
Tshwane (2010) Total Surveys 400	Car: 100	Waiting time In-vehicle time Fare[1] No. of transfers	Car BRT	20 (Likert 5 Pt Scale)	Car
	Taxi: 100		Taxi BRT	20 (Likert 5 Pt Scale)	Taxi
	Train: 100		Train BRT	20 (Likert 5 Pt Scale)	Train
	Bus: 100		Bus BRT	20 (Likert 5 Pt Scale)	Bus
Notes:	1. Public transport fare included, car out-of-pocket costs not included.				

3. ESTIMATED VALUES OF TRAVEL TIME SAVINGS (VTTS)

The following table summarises the reported willingness to pay (WTP) measures as estimated by the VTTS for each metro. (Note: The abbreviation PT = Public Transport).

Table 2: Reported WTP Measures from Trip Utility Equations: VTTS (Rand/hour)

Metro	Income Level / Mode	Income Segment (Rand/Household/Month)	Value of Travel Time Savings VTTS* (Rand/hour)
Ekurhuleni (2013)	Car	All Incomes	R83.36
	Taxi	All Incomes	R14.71
	Train	All Incomes	R14.71
Tshwane (2010)	All Modes (car, bus, taxi, rail)	All Incomes	R5.31
Note: * VTTS not corrected for time value of money, i.e. Tshwane is in 2010 Rands and Ekurhuleni in 2013 Rands.			

The highlights from Table 2 are:

- VTTS for public transport users are less than R15.00 per hour, although there is significant variation below this level;
- There is a wide variation of VTTS estimates for PT between Ekurhuleni and Tshwane;
- An apparently high VTTS for Ekurhuleni car users.

4. CONJOINT ANALYSIS AND DISCRETE CHOICE EXPERIMENTS

Conjoint analysis (CA) has its origins in applied psychology, specifically research that dealt with the mathematical representation of the behaviour of survey participants using rankings (or ratings) that are observed as an outcome resulting from the systematic manipulation of independent attributes. From the 1960's onwards, the method became more commonly applied in market preference studies for different products and services, and in fact it is still widely used today.

Conjoint analysis evolved out of the theory of Conjoint Measurement (CM) which is a purely mathematical construct, and concerned with the (linear) behaviour of number systems, not the behaviour of human preferences. Louviere (Louviere, Flynn, & Carson, 2010) highlights two restrictions of CM:

i. The association of CM methods with utility are tenuous, and have been superseded by standard neoclassical utility theory and its variants such as prospect theory;
ii. There is no statistical or other error theory that allows the theory to be represented as testable statistical models.

Unlike CM, Discrete Choice Experiments (DCE) and models (DCM) are based on a long-standing and well-tested theory of choice behaviour that can take inter-linked behaviours into account. This theory is known as Random Utility Theory (RUT), and it provides an explanation of the choice behaviour of humans.

RUT proposes that the concept of utility is made up of two components, a systematic (observable) component and an unobservable random component. The systematic component consists of the measurable attributes that describe the differences between the alternatives in a choice environment. The random component includes all the unidentified (and unobserved) factors that influence choice. Furthermore, unlike CA, DCMs use the economic concept of utility maximisation subject to some type of constraint.

DCE applications can resemble CA because both use survey questions about combinations of attribute levels, requiring a respondent to trade-off the attribute values of each alternative. In CA, respondents are asked to rate the alternatives in the choice set by considering the attribute values (rating responses offer benefits over rankings). The 5-point Likert rating scale is commonly used. DCE's require the respondent to make a choice between two or more alternative products or services.

Therefore, DCM's provide a richer explanation of human choice behaviour, and provide the analyst with deeper insights into the factors affecting choice.

5. STATED PREFERENCE SURVEY DESIGNS

A review of the Tshwane and Ekurhuleni SP designs revealed the following for both surveys:

- The out-of-pocket costs for car users was not included in the surveys. This is an important oversight, as excluding these costs are likely to distort the conjoint-based and DCM's estimated for the car market segment;

- The choice set designs were not orthogonal, i.e. independent of one another. This can give rise to counter-intuitive signs for attribute coefficients, especially when using conjoint methods;

- Computer aided personal interviews (CAPI) was not used. Some analysts consider CAPI as standard practice (Hess & Rose, 2009). It not only enables customisation of the alternative mode attributes in the choice sets for each respondent, but the automated compilation process enables rapid result evaluation and survey management intervention if required. However, CAPI increases survey development costs as it requires the sourcing and programming of hand-held computers;

- Best practice requires that the SP choice sets should include the trip time and cost attribute details of the respondent's current mode (i.e. their Revealed Preference or RP) that can be used as the pivot points from which to estimate the alternative mode attributes (Roman, Martin, Espino, & Arencibia, 2011; Hess & Rose, 2009). Both the SP and RP data can then be used to estimate the utility equation and calibrate the DCM. This was not done;

- That said, the attribute value pivoting process must be done very carefully to ensure the alternative mode attribute trade-offs are realistic and relevant (Hess & Rose, 2009). Pivoting should be done especially carefully when dealing with car (as current mode) and public transport alternatives such BRT and rapid rail.

The following figure serves as a high-level summary requirement for designing and executing SP surveys.

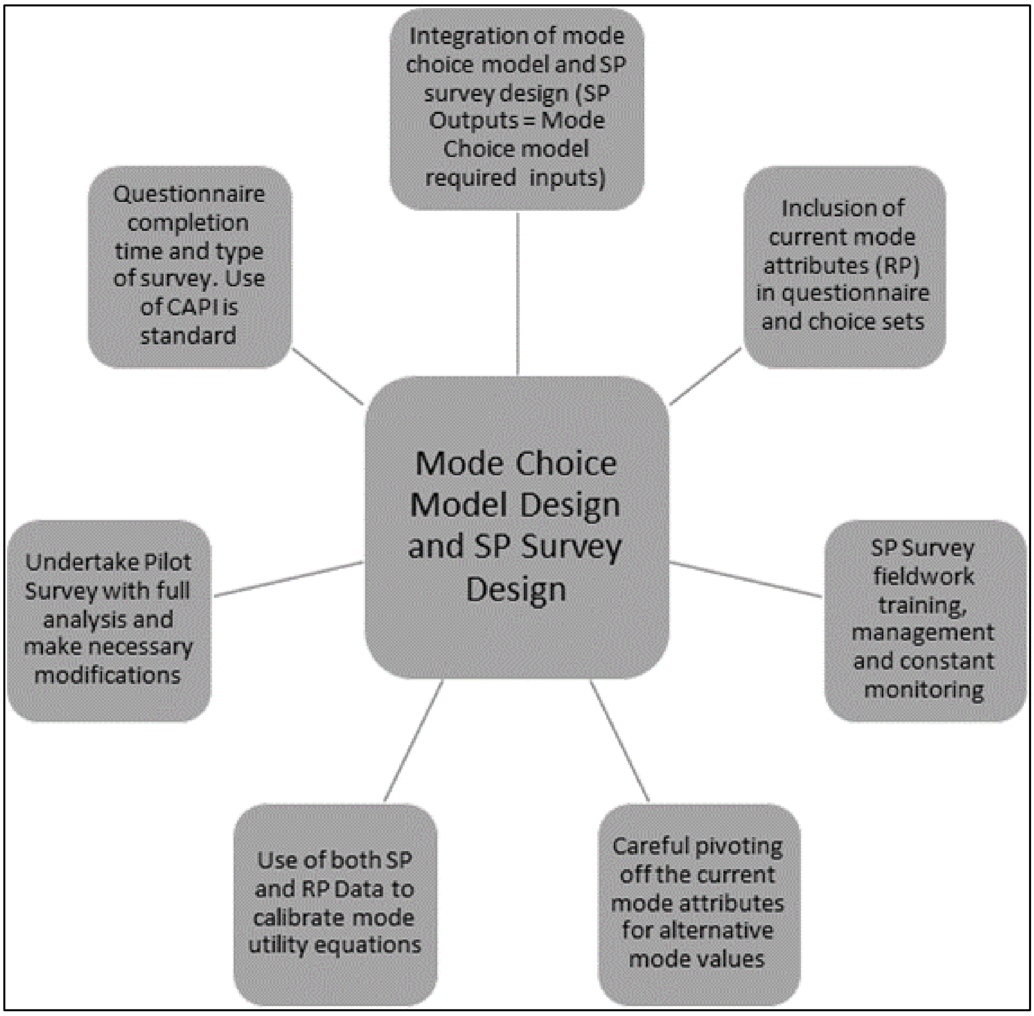

Figure 1: High Level Summary of Mode Choice Model and SP Experiment Design Requirements.

6. RESULTS OF CONJOINT ANALYSIS BY MODE

The SP data was used to derive estimations of the utility attribute coefficients and their statistical significance. The following tables show the conjoint-based model results by mode for both metros for all income groups.

The table highlights are:

- The attribute coefficient signs all have the right signs (i.e. positive);

- The Tshwane bus model is not statistically significant, with several attributes having low t-ratios. These low t-ratios imply that the attribute coefficient is not significantly different from zero, and hence infers that the respondents do perceive any difference in the attribute between the modes;

- The Ekurhuleni car model also has attribute coefficients with low t-ratios, i.e. the attributes are not significantly different from zero;

- The Tshwane taxi and rail model attributes coefficients are significant. The BRT ASC values are close to 3.00 for these modes, showing little preference for BRT over their current mode when the unobserved factors of utility are considered (recall that the original conjoint rating scale was a 5 point Likert scale, with a value of 3.0 representing indifference between the two modes);

- The Tshwane public transport model (including bus) is a robust model with high t-ratios. The BRT ASC close to value of 3.0 reveals indifference to BRT;

- The Ekurhuleni taxi and rail models are also statistically significant, and the combined taxi and rail model is also robust, i.e. the attributes have high t-ratios;

- The willingness-to-pay measured by the VTTS reveals that:
    - The Tshwane taxi and rail modes have similar VTTS values of R7.50 per hour and R6.31 per hour. The Tshwane bus VTTS is in-valid;
    - The Tshwane car model has a VTTS of R10.29 per hour, and the Ekurhuleni car value is R14.04 per hour;
    - The consolidated Tshwane public modes have a value of R14.00 per hour. While this model is robust, the high VTTS is clearly biased by the bus mode;
    - The Ekurhuleni taxi and rail VTTS values are similar, i.e. R8.96 and R8.53 per hour respectively. These values are relatively similar to the Tshwane taxi and rail values;
    - The consolidated Ekurhuleni taxi and rail model shows a VTTS of R8.86 per hour;

- Overall, the Tshwane and Ekurhuleni taxi and rail VTTS values are within a reasonably narrow range of each other, i.e. between R6.31 per hour and R8.96 per hour.

Table 3: Tshwane Conjoint-Based Utility Attribute Coefficients by Mode & VTTS (Rand/hr) (t-ratios at 95% Confidence Interval)

Tshwane MNL	Taxi		Bus		Rail		Public Modes (Taxi, Bus, Rail)		Private Car	
Attribute	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**
Wait Time (min)	0.0148	5.24	0.0072	*2.04*	0.0087	2.55	0.0129	6.77	0.0165	3.23
Travel Time (min)	0.0120	7.55	*0.0088*	*0.26*	0.0252	4.83	0.0077	5.63	0.0120	9.79
Fare (R)	0.0959	7.53	*0.0067*	*1.28*	0.2397	11.30	0.0331	7.74	0.0700	3.72
No. Transfers	0.6454	25.62	0.543	18.10	0.2930	9.53	0.5230	30.78	0.0961	2.13
BRT ASC	2.98	86.67	3.3035	53.12	3.0850	27.10	3.1670	119.10	1.6720	7.20
VTTS (Rand/hour)	**7.50**		***78.81***		**6.31**		**14.00**		**10.29**	

Table 4: Ekurhuleni Conjoint-Based Utility Attribute Average Coefficients by Mode & VTTS (Rand/hr) (t-ratios at 95% Confidence Interval)

Ekurhuleni Multinomial Logit	Taxi		Rail		Private Car		Public Modes	
	Coefficient	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**
Wait Time (min)	0.0303	8.78	0.0208	5.59	0.0199	2.87	0.0234	9.97
Travel Time (min)	0.0261	6.88	0.0141	2.90	0.0257	3.62	0.0258	12.45
Fare (R)	0.1752	7.78	0.0992	4.79	0.1099	*1.99*	0.0911	8.52
No. Transfers	0.3323	12.75	0.1424	3.98	0.1231	*1.00*	0.2430	12.12
BRT ASC	2.646	44.93	2.436	15.19	0.8534	*1.02*	2.689	72.31
VTTS (Rand/hour)	**8.96**		**8.53**		**14.04**		**8.86**	

7. DISCRETE CHOICE MULTINOMIAL LOGIT (MNL) MODEL RESULTS

The development of the DCMs required the conversion of the CM rating responses to discrete choice preferences. The 5 point Likert scale was converted to a binary choice preference (as required for DCMs) with the following conversion assumptions:

Table 5: Likert 5-Point Scale Conversion to Binary Choice

Respondent Preference Rating	Conjoint Likert Scale	Discrete Binary Choice
Strongly Prefer Current Mode	5	0
Prefer Current Mode	4	0
No Preference	3	Data Removed
Prefer BRT Mode	2	1
Strongly Prefer BRT Mode	1	1

MNL choice models were developed by mode for both sets of SP data. ASC's were estimated for the BRT mode, and the current mode ASC normalised (i.e. set to zero). The willingness to pay as measured by the VTTS is the ratio of the travel time and fare attribute coefficients. The results are shown in the following tables.

The tables show that for the MNL models:

- The Tshwane models are statistically significant except for the bus model that has incorrect attribute coefficient signs;

- The Tshwane rail, taxi and consolidated public transport VTTS estimates are similar, and are significantly less than the car estimate. Excluding the bus mode, the consolidated model has resulted in a more realistic estimate of the VTTS (i.e. R6.44 per hour). The PT VTTS values are similar to the conjoint-based values;

- The Tshwane car MNL model is significant, with a VTTS estimate of R18.34 per hour. This is significantly higher than the value estimated by the conjoint model, i.e. R10.29 per hour;

- The Tshwane MNL VTTS for all modes (R8.72 per hour) is significantly higher than the original conjoint estimate of R5.31 per hour;

- The Ekurhuleni MNL public transport VTTS values are similar to the conjoint-based values, and are also similar to the Tshwane rail and taxi values;

- The Ekurhuleni car VTTS (R24.00 per hour) is significantly different to the conjoint-based estimate of R14.04 per hour, and is higher than the Tshwane value of R18.34 per hour. However, the Ekurhuleni car MNL model, like the conjoint-based model, has several attributes coefficients that are not significantly different to zero (i.e. low t-ratios), reflecting respondent indifference to these attributes;
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- There is consistency across all modes and both metros for the transfer attribute being the most important in the trip utility (i.e. highest coefficient value), followed by the fare attribute. There is inconsistency between the walk and travel time attributes;

- In Tshwane, only car users (and to a much lesser extent rail users) have a favourable preference for the BRT mode (i.e. Car-BRT ASC=1.86). In Ekurhuleni, both rail and car users have some preference for the BRT mode compared to taxi users (ASC's of 2.67 and 2.44 respectively).

Table 6: Tshwane DCM Multinomial Logit Model Utility Attribute Average Coefficients by Mode & VTTS (Rand/hr) (t-ratios at 95% Confidence Interval)

Tshwane MNL	Taxi		Bus		Rail		Public Modes (Excl. Bus)		Private Car		All Modes (Excl. Bus)	
Attribute	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**
Wait Time (min)	-0.0279	-5.54	-0.0082	*-1.73*	-0.0112	-2.25	-0.0183	-5.20	-0.0223	-2.30	-0.0182	-5.57
Travel Time (min)	-0.0234	-8.10	*0.0185*	4.92	-0.0327	-4.54	-0.0234	-9.03	-0.0377	-9.79	-0.0282	-13.37
Fare (R)	-0.1932	-8.11	-0.2983	-10.85	-0.3117	-9.65	-0.2180	-12.05	-0.1235	-3.37	-0.1940	-12.14
No. Transfers	-0.9412	-17.63	-0.6850	-14.37	-0.3953	-8.88	-0.6620	-19.72	-0.1739	-2.00	-0.6100	-19.92
BRT ASC	-0.2109	-3.53	0.7658	8.78	0.1949	*-1.22*	0.0000[1]	-	1.8560	4.00	0.0000[2]	-
VTTS (Rand/hour)	**R7.27**		***-R3.72***		**R6.30**		**R6.44**		**R18.32**		**R8.72**	
Log-Likelihood	-845.112		-895.567		-894.692		-2726.677		-544.610		-2349.7	
Prob > $\|Chi^2\|$	0.000		0.000		0.000		0.000		0.000		0.000	

1: *Taxi ASC = -0.208 (t-ratio = -3.68); Rail ASC = 0.366 (t-ratio = 3.94).* ***2:*** *Taxi ASC = -0.205 (t-ratio=-3.63); Rail ASC = 0.464 (t-ratio=5.98); Car ASC = -2.99 (t-ratio=-14.75).*

Table 7: Ekurhuleni DCM Multinomial Logit Model Utility Attribute Average Coefficients by Mode & VTTS (Rand/hr) (t-ratios at 95% Confidence Interval)

Ekurhuleni Multinomial Logit	Taxi		Rail		Private Car		Public Modes		All Modes	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Wait Time (min)	-0.038	-7.16	-0.030	-5.43	-0.038	-3.77	-0.032	-8.98	-0.032	-9.84
Travel Time (min)	-0.039	-6.71	-0.019	-2.64	-0.040	-3.86	-0.031	-7.31	-0.033	-8.45
Fare (R)	-0.270	-7.76	-0.153	-5.05	-0.100	*-1.29*	-0.172	-8.16	-0.158	-8.14
No. Transfers	-0.434	10.22	-0.119	-2.27	-0.291	*-1.65*	-0.297	-9.89	-0.304	10.34
BRT ASC	0.257	2.96	2.670	2.67	2.444	2.07	0.000[1]	-	0.000[2]	-
VTTS (Rand/hour)	**R8.67**		**R7.45**		**R24.00**		**R10.81**		**R12.53**	
Log-Likelihood	-1148.5		-621.4		-475.8		-1784.2		-2262.1	
Prob > $\|Chi^2\|$	0.000		0.000		0.000		0.000		0.000	

1: *Taxi ASC=-0.15 (t-ratio = -1.99); Rail ASC=-0.56 (t-ratio = -3.68).* ***2:*** *Taxi ASC=-0.17 (t-ratio = -2.42); Rail ASC=-0.46 (t-ratio = -3.27); Car ASC=2.97 (t-ratio=11.3)*

8. CONSOLIDATED TSHWANE AND EKURHULENI MNL MODELS

The following table shows the consolidated Tshwane and Ekurhuleni MNL model results for the taxi, rail and car modes. All the models are statistically significant. Only car users show preference for the BRT mode when the unobserved factors of utility are considered (i.e. a positive ASC). This result raises concerns for the anticipated diversion of taxi and rail trips to the proposed new BRT services.

Other observations are:

- The public mode VTTS values are very similar, i.e. R6.37 per hour and R7.28 per hour for the taxi and rail modes respectively;
- The transfer attributes have the highest value, followed by the fare;
- For taxi and rail users, the travel time attribute coefficient is less than the waiting time value. This is an important observation, reflecting that taxi and rail users consider high frequency and lower cost services more important than fast services that reduce travel time. This confirms the results found in Johannesburg by Venter (Venter, 2016) ;
- The car VTTS is approximately four times the level of the VTTS for public modes;
- Car users show considerable preference for the BRT mode when the unobserved factors of utility are considered, i.e. car-BRT ASC=1.589 compared to taxi-BRT ASC=-0.076 and rail-BRT ASC=-0.211. Once again, this result has important implications for the success of the BRT systems in these metros, i.e.:
    - o The provision of high frequency, reliable, and low cost services in preference to high speed services;
    - o The removal of competing taxi services in the BRT corridors;
    - o The provision of attractive car user BRT features such as park and ride and drop-off facilities at certain terminals and stops.

Table 8: Consolidated Tshwane and Ekurhuleni MNL Utility Attribute Average Coefficients by Mode and VTTS (Rand/hr) (t-ratios at 95% Confidence Interval)

Tshwane and Ekurhuleni MNL	Taxi		Rail		Private Car	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Waiting Time	-0.032	-9.58	-0.028	-5.08	-0.027	-4.03
Travel Time	-0.022	-9.56	-0.023	-6.65	-0.034	-9.76
Fare/Cost	-0.209	-11.42	-0.193	-5.48	-0.081	-2.76
No. Transfers	-0.588	-19.62	-0.941	-9.31	-0.146	-2.20
BRT ASC	-0.076	*-1.81*	-0.211	-3.59	1.589	4.06
VTTS (Rand/Hr)	**R6.32**		**R7.15**		**R25.18**	
Log-Likelihood	-2059.3		-1609.6		-1033.4	
Prob > |Chi2|	0.0000		0.0000		0.0000	

Overall, the consolidated MNL models provide more consistent and more robust results than the original conjoint-based models and MNL models.

9. CONCLUSIONS

This analysis has shown that:

- The MNL models are generally more statistically significant than the conjoint-based models. However, there are some consistencies between the models;

- The MNL model VTTS values are generally higher than the conjoint-based estimates;

- For Ekurhuleni, both the conjoint-based and MNL car models are not statistically significant. The Tshwane car conjoint-based and MNL are significant. This leaves a gap in the understanding of car user behaviour and VTTS in Ekurhuleni, and uncertainty of the attractiveness of BRT for car users;

- There is a gap in the understanding of bus user commuting preferences in Tshwane in as far as BRT is concerned;

- The two model types show dis-similar preferences for the BRT modes as follows:
  - The Tshwane conjoint-based models show little preference for the BRT mode by public transport users, and some preference by car users;
  - The Tshwane MNL model reveals some preference for the BRT mode by rail users, but not by taxi users. There is a strong preference for BRT by car users when the unobserved factors of utility are considered;
  - The Ekurhuleni conjoint models show strong preference for BRT by the public modes and the car mode;
  - The Ekurhuleni MNL's show strong preference for the BRT mode by rail users, but less so by taxi users;

- There is some consistency between the Ekurhuleni conjoint-based and MNL based VTTS, i.e. R8.86 per hour versus R10.94 per hour;

- The original all-mode conjoint model for Tshwane has a significantly lower VTTS value than both the MNL models, i.e. R5.31 per hour versus R8.72 per hour and R12.55 per hour;

- The MNL model results confirm the results obtained by Venter (Venter, 2016) that potential BRT users would prefer more frequent services with transfers minimised and low fares rather than high travel speeds (i.e. shorter in-vehicle travel times).

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