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A study on the determinants of Ethiopian minibus taxi drivers' speeding behaviour: An application of the 'major theorists' model

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Abstract

Speeding is the most common road safety problem that results in many traffic accidents in Addis Ababa, Ethiopia. Minibus taxis substantially contribute to speed-related road traffic crashes in Addis Ababa. This study aimed to investigate minibus taxi drivers' speeding behaviour using the 'major theorists' model, an integrated framework drawn from five dominant motivational models. Participants were 218 Ethiopian male minibus taxi drivers in Addis Ababa. The study followed a three-step sequential procedures: 1. Development of a new instrument addressing the assumptions of the 'major theorists' model, and validation using Principal Component Analysis (PCA). 2. Exploration of associations between variables in the 'major theorist' model using a Pearson's correlation analysis. 3. Identification of statistically significant predictors of self-reported speeding via linear multiple regression analyses. It was found that self-efficacy to drive fast, weak speed enforcement, social pressure from relatives to drive fast, and behavioural intention to drive fast were significant predictors of self-reported speeding behaviour. These findings can be applied in awareness rising interventions for taxi driver to improve their speed limit compliance.

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1. Introduction

Speeding behaviour is one of the major contributing factors for deaths, injuries, and material damages [1, 2]. Driving at high speed affects the road user's observation, time to take evasive action, and braking distance [3, 4]. In this regard, a minor change in driving beyond the speed limit can result in a higher change in accident rate [See 5, 6]. Indeed, driving beyond the posted speed limit increases not only the probability of experiencing a traffic crash, but it also increases the degree of damage and fatality [3, 7, 8]. In Ethiopia, driving beyond the speed limit is one of the contributing factors that increases the probability of engaging in traffic accidents [9]. The Addis Ababa Police Commission report indicated that many accidents in the City are caused by inappropriate speed, such as driving beyond the speed limit, driving quickly without giving priority to pedestrians on the crossroad, and improperly overtaking other vehicles [10]. The same report also indicated that minibus taxis took the lion's share for traffic accidents in the City for several consecutive years. Another road safety report based on direct observation indicated that 72% of minibus taxi drivers in Addis Ababa violated the City's speed limit [9]. A local study by [11] also confirmed that drivers who drive minibus taxis engage in driving beyond the speed limit. In this regard, there is no much empirical works that has investigated the factors behind driving beyond the speed limit in Addis Ababa. Drivers who fail to comply with the speed limit may hold weak appraisal of the benefits of normal speeds, question the risks for high speed, over-estimate their driving skill relative to other drivers, or possess habits related to driving fast [12]. Many researchers investigated psychological factors associated with speeding using social cognition models, for instance, the Theory of Planned Behaviour [13], Protection Motivation Theory /PMT/ [14], and Social Cognitive Theory /SCT/ [15]. According to [16], social cognition models share many related constructs and integration of such common features may help develop a comprehensive theory that can better predict a given behaviour (e.g., speeding). This was precisely the purpose behind the so-called 'major theorists' model.

1.1. Theoretical framework: situating the 'major theorists' model in speeding context

The 'major theorists' model is the outcome of a workshop that was carried out by leading proponents of five major behavioural theories: Bandura (Social Cognitive Theory), Becker (Health Belief Model), Fishbein (Reasoned Action), Kanfer (Theory of Self-Regulation and Self-Control), and Triandis (Subjective Culture and Interpersonal Relations) [17]. The workshop aimed at discussing some main points of consensus among these models. In the workshop, key-variables, namely, positive intention, skills, attitude, social pressure, self-efficacy, environmental constraints, self-image, and emotional reaction were identified as determinants of behaviour [17]. In this study, the key-determinants of behaviour have been applied to speeding. *Skills to drive fast:* In this study, skills to drive fast were captured by means of a self-report measure, i.e., minibus taxi drivers' self-appraisal of their personal skill in driving fast across different road traffic contexts. *Behavioural intention to drive fast*: Intentions can be contextualized as the cognitive representation of individuals' plan to engage into speeding [13]. Specifically, behavioural intention [18] is the degree to which a person has formulated conscious plans [Warshaw & Davis, 1985, p. 214 in 19] to drive fast in different road traffic contexts. *Environmental context:* The driving environment encompasses both physical and legal aspects that may play an important role in driving fast or not. For instance, [20] indicated that road geometry and weather conditions affect a driver's decision to comply with the speed limit or not. Drivers' travel practice depends on the interaction with the environmental context which may involve enforcement resources, speed limits, and road conditions [21]. Environmental context, thus, refers to the traffic context, included therein the physical and enforcement conditions that influence drivers' practice. According to [17], in the 'major theorists' model, social pressure, self-efficacy, and attitude are the primary predictors of the behavioural intention to perform a behaviour. Paris and Van den Broucke applied attitude, social pressure, and self-efficacy concepts to speeding behaviour [22]. An *attitude towards driving fast* is likely comprises the expected outcomes of speeding behaviour, and the affective appreciation of these outcomes. *Social pressure to drive fast* refers to a perceived social influence to drive fast, and is derived from the observation of others' behaviour, and direct feedback from important social referents. *Self-efficacy to drive fast* refers to the degree to which an individual believes that his/her speeding behaviour is under his/her control. Finally, S*peeding behaviour* in this study is defined as driving beyond the legal speed limit in a given road context.

1.2. Objective

The 'major theorist' model, [17] theorized that environmental context, skill and intentions are the main predictors of behaviour. Put differently, besides a strong intention to perform a certain behaviour, individuals also

need to possess the skill to perform that particular behaviour [23], and the environmental context should offer the opportunity for a certain behaviour to be carried out [24]. Fishbein and his colleagues further indicated that the remaining variables, i.e., attitude, social pressure, self-efficacy, and self-image would affect the strength of intention to predict behaviour [17]. Following the assumptions implied by the 'major theorist' model, we propose the following three objectives:

    a. To predict self-reported speeding behaviour from the three primary constructs, i.e., perceived driving skill, behavioural intention, and environmental context;

    b. To predict behavioural intention from attitude, social pressure, and self-efficacy;

    c. To predict self-reported speeding from all selected constructs in the 'major theorist' model including behavioural intention, perceived driving skill, environmental context, attitude, social pressure, and self-efficacy.

2. Methods

2.1. Participants

In collaboration with a team of well-trained data collectors from the Addis Ababa City Transport Program Management Office (TPMO), the principal researcher recruited participants using a convenience sampling method. Respondents were recruited in a series of predetermined taxi stations from which they depart to different directions. In Ethiopia, taxi driving is a male dominated job. Thus, in total, 218 Ethiopian male minibus taxi drivers participated in this study. The age range of participants was between 20 and 68 years, with a mean of 32.38 years and a Standard Deviation (SD) of 7.64. Driving experience of participants ranged from 0.03 to 20 years with an average of 5.82 years and SD = 5.02 years.

2.2. Questionnaire development

An item bank, which consisted of more than 505 items covering the selected constructs in the 'major theorist' model was created to develop the data collection instrument. Such items were prepared by assessing different information sources, including an interview and Focus Group Discussion (FGD) with taxi drivers working in Addis Ababa, peer-reviewed journal articles, local transport reports, recorded local traffic-related video, and personal experiences. Questions in FGD and interviews were prepared to address predisposing, reinforcing, and enabling factors of the speeding among minibus taxi drivers in Addis Ababa. Experts screened important items from the items bank that could fit with each selected construct in the 'major theorists' model. These experts also engaged in a ranking technique to identify the final list of items. Initially, seven items were retained for measuring environmental context (e.g., *Speed breakers limits my speedy driving*), eleven items for measuring attitude (e.g., *Driving fast aids me to reach at my destination more quickly*) and nine items for measuring social pressure (e.g., *Driving fast is culturally considered as a sign of heroism*) were identified. Additionally, four items were proposed for measuring perceived skills to drive fast (e.g., *I am skillful to drive fast on all types of roads*); seven items for measuring speeding behaviour (e.g., *How often do you drive fast on a freeway?*); four items for self-efficacy (e.g., *I believe my driving skills can meet the challenges of speeding*); and five items for measuring behavioural intention to drive fast (e.g., *Imagine driving on the road where there is free traffic volume, do you intend to drive fast*).

2.3. Data collection process

Suitable time schedules to approach minibus taxi drivers were identified. Data collectors approached participants during the less busy working period and only contacted participants who had parked their taxis while waiting for passengers. The selected time slots to approach participants were late morning (9:30 – 12:10), and early afternoon (14:00 – 16:30) hours. Each participant received a study description before asking for willingness to participate in the study. Oral consent was first obtained before participants were asked to fill the self-report questionnaire. Taxi drivers could complete the paper-pencil questionnaire from within their vehicle. During that time, they were free to ask for clarifications in case items were not clear to them. Overall, the total procedure took no longer than 30 minutes.

2.4. Data analysis

Principal Component Analysis (PCA) analyses with different rotation techniques were initially employed for data reduction. In the second stage, Pearson's correlation analyses were employed to explore associations between variables. Finally, linear multiple regression analyses were conducted to identify statistically significant predictors of self-reported speeding.

3. Results

3.1. Data reduction

We employed Principal Component Analysis (*PCA*) for data reduction. Prior to evaluating the results of *PCA*, the Kaiser-Meyer-Olkin and Barlett's Test of Sphericity were conducted to determine sample size adequacy. The value of *KMO* measurement was 0.822, and Barlett's test of Sphericity $x2$ (1035, N = 218) = 3900.93, $p <$ .001, indicating that the sample size was adequate. In the first analysis, all 47 items were included in a single *PCA*, using the eigenvalue >1 criterion to determine the number of components to be extracted. Different rotation techniques were employed to yield maximum discrimination between the scales measuring the variables from the major theorists' model. Ultimately, a PCA with Varimax rotation provided an interpretable factor solution for 20 items measuring attitude, behavioural intention, perceived skill, and speeding behaviour (see sub-topic 3.2.1, and appendix A). As we observed in [22], for the remaining variables (i.e., environmental context, self-efficacy, and social pressure), we computed a separate *PCA* with Varimax rotation on their respective items (see sub-topic 3.2.2, and appendix A).

3.2.1. Attitude, behavioural intention, speeding behaviour, perceived driving skill

We initially used 27 items measuring the different variables from the 'major theorists' model. A Principal Component Analysis *(PCA)* with Varimax rotation using the eigenvalue >1 to determine the number of components extracted, proposed a four-factor solution that accounted for 55.85% of the variance and retained 20 items. More in detail, five items loaded upon an attitude-factor, four items on a perceived driving skill factor, five items on a behavioural intention factor, and six items on a speeding behaviour factor. In total, six items for attitude, and one item for speeding behaviour were discarded to obtain the factor loading presented in Appendix A. The values for Cronbach alpha for attitude, behavioural intention, speeding behaviour, and perceived driving skill ranged from $α$ = 0.6 to $α$ = 0.8 (see Table 2).

3.2.2. Self-efficacy, social pressure and environmental context

As for Social pressure to drive fast*:* A *PCA* of nine items measuring this variable produced a 3-factor solution explaining 54.84% of the variance. After removal of two items loading on a non-interpretable factor, another *PCA* analysis resulted in a two-component solution accounting for 50.87% of the variance. The first component contained four items, whereas the second component consisted of 3 items. The first component reflected social pressure to drive fast arising from other persons on the road (*SPRPR*) (e.g., *my driving fast goes with the speeders around me in the traffic flow*) while the second component reflected social pressure to drive fast generated by relatives (*SPRR*) (e.g., *Most people that are important to me find that I should not drive fast*). Cronbach alphas for *SPRPR* and SPRR were $α$= .61 and $α$= .53 respectively. A PCA on the seven items measuring the variable 'environmental context to drive fast': produced a 2-factor solution explaining 43.10% of the variance. The first component contained three items, whereas the second component consisted of four items. The first component referred to enforcement-related circumstances of the environment (e.g., *If I am punished, my driving fast continues until (within 72 hours) I am supposed to pay that fine*), while the second component reflected physical conditions (e.g., *Speed breaker limits my driving fast*). Cronbach's alphas were $α$ = .5 and $α$ = .4 respectively. Finally, a PCA on the four items measuring self-efficacy produced a 2-factor solution explaining 64.69% of the variance with the first component containing three items, and the second only one. The second component reflected drivers' belief that they felt confident in driving fast in high-speed areas. The first component reflected the belief that respondents were self-confident in driving fast in general. The Cronbach's alpha for measuring self-efficacy to drive fast in general was $α$ = .54. The factor with only one item was not considered for further analysis.

3.2. Correlation analysis

To investigate associations between the various constructs in the 'major theorist' model, we used Pearson's correlation analysis. The inter-correlations coefficient, mean, standard deviations, and reliability values are presented in Table 1. Statistically significant small to moderate positive correlations were established between self-reported speeding behaviour and behavioural intention to drive fast (r = .42, p < .01), perceived driving skill to drive fast (r = .33, p < .01), enforcement environment in driving fast (r = .39, p < .01), Self-efficacy to drive fast (SE) (r = .42, p < .01), physical environment to drive fast (PE) (r = .25, p < .01),   SPRPR (r = .41, p < .01), and SPRR (r = .23, p < .01). Furthermore, statistically significant small positive correlations were observed between behavioural intention to drive fast and its assumed predictors, i.e., attitude towards driving fast (r = .22, p < .01), social pressure to drive fast raise by other people on the road (r = .24, p < .01), and self-efficacy to drive fast (r = .27, p < .01).

Table 1 *Means, Standard Deviations, Reliability Coefficients, and Inter-correlations between variables*

Variables	1	2	3	4	5	6	7	8	9
Speeding Behaviour	α = .83								
Behavioural Intention	0.42**	α = .83							
Attitudes	0.26**	0.22**	α = .79						
PDS	0.33**	0.31**	0.46**	α = .61					
SPRPR	0.41**	0.24**	0.58**	0.49**	α = .61				
SPRR	0.23**	0.05	-0.24**	0.10	0.01	α = .53			
EE	0.39**	0.24**	0.49**	0.40**	0.62**	0.01	α = .50		
PE	0.25**	0.17*	0.31**	0.29**	0.33**	0.10	0.10	α = .41	
SE	0.42**	0.27**	0.49**	0.54**	0.54**	0.12	0.44**	0.22**	α =.54

Note: 1 = Speeding Behaviour; 2 = Behavioural Intention; 3 = Attitude towards driving fast; 4 = perceived driving skill (PDS). 5 = Social pressure to drive fast raise from persons on the road (SPRPR); 6 = Social pressure to drive fast raise by relatives (SPRR). 7 = Enforcement Environment to drive fast (EE);   8 = Physical environment to drive fast (PE); 9 = Self-efficacy to drive fast (SE).   * P ≤ .05   **P ≤ .01

3.3. Regression analysis

A multiple regression analysis was conducted to identify statistically significant predictors of self-reported speeding behaviour. In verification of the first study objective, multiple regression analysis was able to explain 29% in speeding behaviour (R^2 = .29; F (4, 213) = 22.17, p < 0.001) with speeding being positively predicted by behavioural intention to drive fast (β = .30, p < .001), enforcement environment to drive fast (β = .26, p < .001) and physical environment to drive fast (PE) (β = .14, p < .05). Perceived skill to drive fast was not a significant predictor (β = .09, p = .183). In accordance with objective two, we performed a multiple regression analysis that explained 9% of the variance in the behavioural intention to drive fast (R^2 = .09; F (4, 213) = 5.28, p < 0.001). Self-efficacy to drive fast was the only significant predictor (β = .17, p < .05).

Table 2 *multiple regression analysis for variables predicting self-reported speeding behaviour*

Variables	B	SE	P	R^2	F
Behavioural intention to drive fast				.091	5.35***
Attitude to drive fast	.09	.08	.28		
Self-efficacy to drive fast	.17	.08	.04		
Social pressure to drive fast raise by other persons on road (SPRPR)	.08	.09	.30		
Social pressure to drive fast raise by relatives (SPRR).	.05	.07	.460		
Speeding behaviour				.29	22.17 ***
Perceived skill (PDS) in speeding	.09	.07	.180		
Behavioural intention to drive fast	.30	.06	.000		
Enforcement environment to drive fast	.26	.07	.000		
Physical environment to drive fast (PE)	.14	.08	.02		
Speeding behaviour				.36	14.86***
Behavioural intention to drive fast	.29	.06	.000		
Enforcement environment to drive fast (EE)	.17	.08	.02		
Physical environment to drive fast (PE)	.09	.08	.13		
Perceived skill (PDS) in speeding	-.02	.08	.79		
Attitude to drive fast	-.02	.07	.74		
Self-efficacy to drive fast	.18	.08	.02		
Social pressure to drive fast raise by persons on road (SPRPR)	.14	.09	.11		
Social pressure to drive fast raise by relatives (SPRR)	.17	.06	.005		

Note: ***significant at p < .001

Finally, to verify objective three, we ran a multiple regression analysis that explained 36% of the variance in speeding behaviour ($R^2 = .36; F (8, 209) = 14.86, p < 0.001$). Significant and positive predictors were behavioural intention ($\beta = .29$, p < .001), self-efficacy ($\beta = .18$, p < .018), SPRR ($\beta = .17$, p < .01), and enforcement environment ($\beta = .17$, p < .025) (See Table 2).

4. Discussion

In this paper, we attempted to address the assumptions implied by the major theorist model. In line with objective one, drivers' self-reported speeding could be predicted by the behavioural intention to drive fast, and by a selection of traffic environment-related factors. Different from that, perceived skills were not a significant predictor. This may indicate that the presence of a future preparedness to engage in speeding in combination with an environment that offers the opportunity to speed are already sufficient to indulge minibus taxi drivers in Addis Ababa to speed. Even though the importance of the necessary skills to perform a certain behaviour are not to be underestimated [e.g., 17, 23, 25], in the specific case of speeding, minibus taxi drivers might be (falsely) inclined to believe that they possess the necessary skills to keep their vehicle under control when speeding since crashes are only rare events and most instances of speeding do not result in an actual crash. Put differently, in the eye of the minibus taxi drivers surveyed in this study, speeding is not so much a matter of owing the appropriate skills, but more a matter of being motivated to do so, and of finding oneself in an environmental context that offers the opportunity to speed. Respondents' behavioural intention to drive fast was only predicted by self-efficacy to drive fast: those who express higher self-confidence in their ability to speed are more intended to speed in the future, which is consistent with previous work [e.g., 22, 26]. Attitude to drive fast and social pressure were both insignificant, which is a finding that differs from what earlier studies found [e.g., 27, 28]. The insignificant result for attitude seems to suggest that the items used for measurement might not have captured the truly relevant beliefs associated with the motivation to speed among Ethiopian minibus taxi drivers. This however, is a bit surprising since the effort of constructing the questionnaire was started with an item elicitation stage where representatives of the targeted population were consulted for what according to their opinion are the outcome expectancies typically associated with the intention to speed. Maybe, the emphasis was too much on the instrumental benefits associated with speeding (e.g., gaining time, being able to pick up more passengers) and not sufficiently enough on experiential benefits of speeding (e.g., excitement) or on a biased underestimation of the objective risks associated with speeding. The fact that no significant effect could be found for social pressure might mean that Ethiopian minibus taxi drivers consider the decision to speed and the consequences of speeding rather as related to the individual than as related to the broader societal environment. The third and final regression analysis found self-reported speeding to be predicted by a combination of behavioural intention to speed, self-efficacy, enforcement environment, and social pressure coming from relatives. Perceived driving skill, physical environment, social pressure from people on the road, and attitude did not predict self-reported speeding. Drivers who are self-confident in the ability to drive fast, have a behavioural intention to drive fast, drive in a weakly enforced environment, and whose relatives approve speeding, self-declared they were more likely to engage in driving fast. Previous literature supports such results [16, 17]. Overall, these results also align with the general assumptions implied by the 'major theorists' model. Social norms, self-efficacy, perceived skills, and environmental opportunities to speed are key factors in predicting this particular behaviour [16] and consequently, are key-targets for behavioural change [29]. These socio-cognitive constructs are thus capital for a better understanding of deliberate behaviour (Fishbein, et al., 2000). Previous work on speeding in general supports the finding that fast-oriented attitudes, subjective norms, perceived behavioural control, intention [30, 31], driving environment [32], and absence or presence of legal measures [33] are significant determinants speeding.

5. Limitations and future research

This study has four major limitations that shall be addressed in future studies. In this study, we relied on self-report data which could be subjected to social desirability problem. Secondly, the study was only delimited to taxi drivers. Thirdly, the data reduction failed to achieve a single PCA for all constructs together. Thus, we computed a separate factor loading analysis for some constructs (e.g., self-efficacy). Fourthly, driving skills were measured using self-report measures instead of an objective measure. To overcome those limitations, future research could focus on ways to reduce social desirability, and replicate the study in other samples (e.g., Bus drivers), and use objective measures.

6. Conclusion

This study explored the underlying determinants of minibus taxi drivers' self-report speeding behaviour using the 'major theorists' model. In this study, we identified that behavioural intention to drive fast, self-efficacy to drive fast, enforcement environment to drive fast, and social pressure to drive fast rise from relatives predicted the self-report speeding behaviour.These findings can be applied in awareness rising intervention for taxi driver so as to may improve the speeding behaviour of those drivers**.**

Acknowledgement

Appendix A

Table 3. Factors loading of items measuring determinants in speeding behaviour

Items	1	2	3	4
Driving fast enables me to reach at destination more quickly	.630			
Driving fast helps me to make frequent trips	.790			
Driving fast assists me to transport many passengers per day	.721			
Driving fast is a solution to win time shortage	.698			
Driving fast helps me to overtake other drivers for securing the first few waiting queue at destination in order to get passengers for the next trip	.652			
How often do you drive fast to generate more daily income?		.771		
How often do you drive fast to run away from traffic light?		.728		
How often do you drive fast on a freeway?		.673		
How often do you drive fast to arrive at destination for securing better queue?		.643		
How often do you drive fast on road where there is no police officer?		.668		
How often do you drive fast in evening?		.681		
I am skilled to drive fast in order to overtake other drivers			**.681**	
I am skilful to drive fast on all types of roads			.687	
I am skilled to drive fast than the average divers do			.629	
During driving fast, I am skilled to manipulate the vehicle without exert much technical efforts			.533	
Imagine you are driving in traffic situation where there are other drivers, so do you intend to drive fast in order to escape from being overtaken by those drivers				.828
Imagine you are driving towards your destination, hence do you intend to drive fast in order to get better queue for having passengers soon				.796
Imagine you are driving for work purpose, do you intend to drive fast to generate more daily income				.770
Imagine you are driving on the road where there is free traffic volume, do you intend to drive fast				.682
Imagine you are driving at evening, do you intend to drive fast to transport large number of passengers				.639

Environmental context	1*	2*		
Night driving allows me to driving fast	.726			
Poor traffic management system in Addis Ababa makes me not comply with the speed limit (r)	.699			
If I am once punished, my driving fast continuous until (within 72 hours) I am supposed to pay that fine	.616			
Low traffic volume increases the chance of my driving fast		.712		
My driving wouldn't be beyond the speed limit, If a hand held speed camera is available around the road r)		.591		
Speed breaker limits my driving fast (r)		.549		
Lack of self-explaining road (e.g., better speed limit signs) influences me to drive fast		.488		

Social pressure to drive fast	1**	2**		
Most passenger in waiting queues influence me to drive fast for a return trip	.755			
My driving fast goes with the speeders around me in the traffic flow	.697			
Most road users crossing behaviour makes me to follow inappropriate speeding patters	.619			
Most police officers push me to respect the speed limit (r)	**.622**			
Most people that are important to me find that I should not drive fast (r)		.808		
Most Ethiopians find it advisable that drivers should not drive fast (r)		.697		
Employer and/or family members want me to generate better daily income at any cost, even by driving fast		.584		

Self-efficacy	1***	2***		
I am confident to drive fast under all traffic conditions	.796			
I choose to drive fast because I trust my driving skill	.686			
I believe I can drive fast on unfamiliar areas	.651			
I believe I can definitely drive fast in high speed areas		.951		

Note: *1- Attitude; 2- Speeding Behaviour; 3- Perceived driving skill; 4- Behavioural intention: 1*- Enforcement Environment: 2*- Physical Environment: 1**- Social pressure to raise by persons on the road: 2**- Social pressure to raise by relatives; 1*** and 2***- self-efficacy.*

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