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Simulation on Fear of Crime among Public Transport Users in Klang Valley Through Regression Analysis Model

Rohana Sham[#1], Shakerin Ismail[#1], Nik Mastura[#1] Noranita Abdamia[#1] Razieman Mohd Yusoff[#1]

#*Faculty of Business and Information Science, UCSI University, Kuala Lumpur, Malaysia*

[1]`rohana@ucsiuniversity.edu.my`

Abstract— **Main results from past studies had indicated that level of fear indication is affected by a wide range of elements such as bus service, infrastructure and social environment where travelling took place.   However, what is less explored is that how these travel satisfaction act as a predictor of travel-related fear. Thus this paper tend to fill the gaps in the existing field of study by examining each of the significant factors that relates to feeling of fear among urban commuters especially for female commuters who live and travel by public bus in urban areas. The paper provide an overview of the elements explaining on how different level of travel satisfaction, can possibly affect the level of fear with a focus on two extreme condition, (i) very satisfied (ii) very dissatisfied. This model highlight a few elements in which travel satisfaction plays an essential role which can results in the formation of higher or lower level of fear. This paper will discuss purely on the fear detector model being generate through multiple regression analysis. The main focus is on the simulation and evaluation of the model produced to measure the different level of fear indication based on the different level of satisfaction.**

Keywords— *Travel, Public Transport, Crime, Safety*

1.   Introduction

An ideal situation in urban area travel is that everybody should indicate a higher level of safety while travelling using a public transport. Feeling of safe can be seen as a basic human need [1] that must be fulfilled to allow individuals to realize their full potential [2]. Not surprisingly, research on fear of crime has become a central area of criminological investigation, as well as a key focus of crime policy throughout the world where women are always reported with a greater fear towards crime [3]. Although it is agreed that levels of fear of crime vary across places [4] there is still little empirical evidence that aims to explain why people feel more fearful in some places than in others. To date, research has mainly focused on examining factors of actual crime that may be associated with fear of crime. Thus this paper search the answer on the question of how to reduce the level of fear among female commuters while travelling into the city centre?

As current literature debate on the methods to evaluate the feeling of fear among women travellers in city centre, therefore this paper starts with the main aim that is to developed a fear detector model that can be used to detect the different level of fear indication based on the satisfaction level indication while using the service. This model can be used to detect the real factors contributing to the lower the fear level indication among female commuters. Where specifically the objectives of the research is to determine the factors of public transport service characteristics, infrastructure and social structure factors that contribute towards the level of fear among women travelers.

This study utilizes a quantitative method as it involved with a bus passenger survey in which a personally administered questionnaire was used as the methodology in data collection. Respondents were selected through quota sampling technique. In total, only working women aged between 18 to 56 years who depend on bus service to commute to workplace were considered in the survey.

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2.   Objectives

The main aim of the research is to determine the factors that affect the level of fear for working woman commuters who live in an urban area, and describe their interrelationship.

Specifically, the objectives are as follows:

i.   To identify factors that significantly affect level of fear among female commuters.
ii.   To develop a model that will reduce the level of fear among female commuters.

3.   Review on Fear of Crime

Many definitions are given on the concept of fear of crime. According to [5], fear of crime is an emotion which is shaped by a range of factors such as gender, age, ethnicity, victimization experiences, neighbourhood characteristics, and environmental features. A study by [6] identified that the back lanes in Kuala Lumpur city centre are always associated with crimes especially if they are dark and dirty. In addition to that, they have also agreed that petty crimes are often reported to happen in the back lanes of the walkways.

Studies, mainly since 2010, have indicated that travel satisfaction – both satisfaction with a specific trip and satisfaction with travel in general – is affected by a wide range of elements (including mode choice, trip duration and travel-related attitudes [7] (Vos and Witlox, 2017).

An earlier study by [8] defined the concept of fear towards crime as a construct that combines human emotion, risk, perception and vulnerability. He further explained the context of crime of an individual that refers to an incident of an individual being attacked by a stranger either on the street, being robbed or mugged on the street, being harassed along the way and being threatened or verbally abused on the street when travelling takes place.

Several approaches have been made by a few researchers to determine the factors that affect woman travelling safety because women are considered as a group of people who would experience the highest risk of being victimized. However, up until today, there is still a lack of support towards women's travel safety issue give in Malaysia. As a result, women in Malaysian urban areas experience a higher feeling of fear of crime in a city [9] (Hamid, 2012 in New Straits Times). A previous study by [10] concluded that appropriate accessibility to safe and good public transport resources is critical especially to those living in the city centre. He further added that central to all movement surrounded women in a city is the concept of safe travel from the point of origin to the point of consumption.

A study by [11] recorded that the habit of many urban dwellers is much influenced by risk and fears of physical attack, harassment and other anti-social behaviour. They also agreed that women are more vulnerable.

Among the influential result in a study conducted by [12] in travel and safety issue is that if women are to travel safely, then the public transport system must first be geared towards their travel needs. Even though lots of work has been done previously to look at the overall issues, more studies need to be conducted to examine critically the real factors that contribute towards the women's travel safety issues, particularly in an urban area.

The issue of travel safety among urban woman travellers is not a new issue. It has gained many discussions on various studies conducted over the past 20 to 30 years because it relates closely with the feeling of safety and fear of crime [13]. The first interest among the researchers in this area is to discover the source of "dark figure" in every crime incidence. This refers to the crime incidence that goes unreported. The researchers also theorized that the existence of fear towards crime is related to the experiences of victimization.

A recent study by [14] reported that plenty of women, much more than men, are afraid of sexual victimization. The assumption was then disputed because many researchers in travel safety issues realized that there are many other influential factors that contribute to the feeling of fear towards crime.

4. Theoretical Perspective

Previous studies done by [7] focus on trip satisfaction with daily travel and life satisfaction. They tends to relate the level of commuters satisfaction with the daily trips experience and also satisfaction in commuters life. However their study had focus less on the factors of bus services, infrastructure and the travelling environment provided to the current commuters as main elements affecting high level of fear.
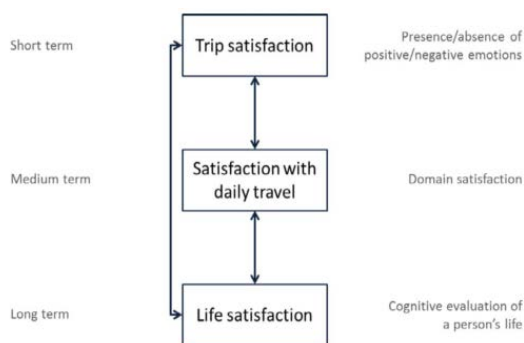

Figure 1.1: Subjective well-being from a travel point of view

Source: [7]

Thus, to fill the gap, this paper focuses on the three main independent variables namely bus service characteristics, infrastructure and social environment and their interrelationship towards the dependent variable (fear of crime) (refer Figure 1.2).

For the first independent variable in this study, it was measured through four critical constructs namely punctuality, comfortability, security and information. Based on previous research in the area of bus service, these are the main critical constructs when measuring travel safety.

As for the second independent variable, the research proceeded with six different constructs to measure the infrastructure in this study. The selection of the six constructs in this study was based on the criticality of the construct to travel safety based on previous studies. This included lighting, pedestrian walkways, fence, visibility, bus stop lighting and walkways to work place.

The third independent variable in this study is social environment. It was measured from six different constructs as well. This is again based on the discussion in the literature especially on the criticality of its impact towards the level of fear. The measurement used included poverty, drug, homeless, prostitution, employment and income.

The dependent variable in this study refers to fear of crime. This variable was measured through a feeling of fear towards crime occurrence.
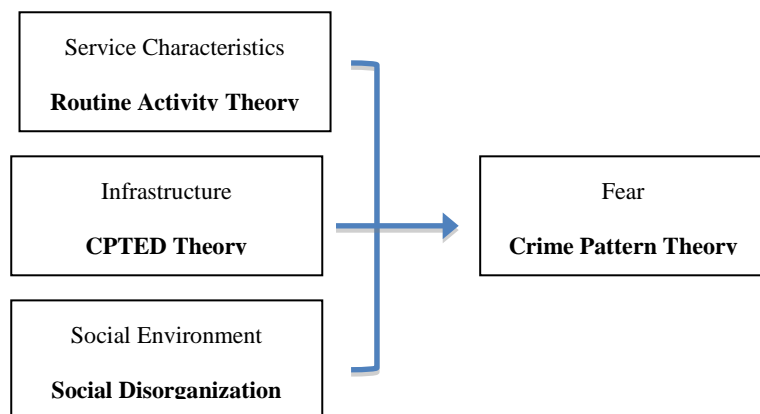

Figure 1.2: Theoretical Framework

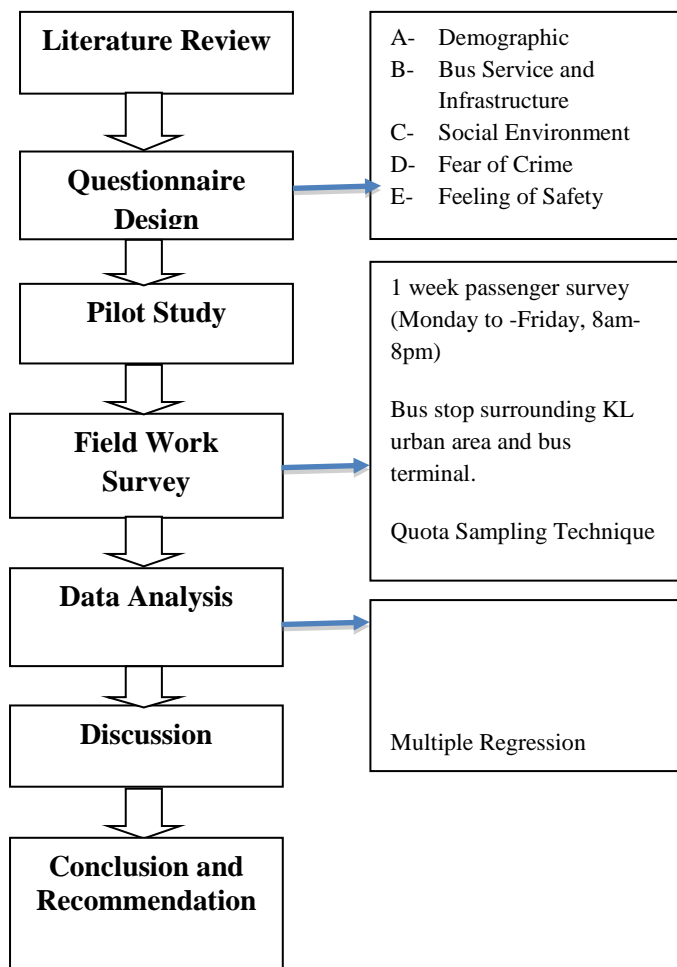Figure 1.2 indicates the main independent variable to be tested towards the dependent variable. It is also clearly shown that each independent and dependent variable is underpinned by a relevant theory to measure the situation.

5.0 Research Design

This is the research flow chart for this study which starts from the literature review in order to search for the gap of the study (refer Figure 1.3)

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Literature Review

A- Demographic
B- Bus Service and Infrastructure
C- Social Environment
D- Fear of Crime
E- Feeling of Safety

Questionnaire Design

Pilot Study

1 week passenger survey (Monday to -Friday, 8am-8pm)

Bus stop surrounding KL urban area and bus terminal.

Quota Sampling Technique

Field Work Survey

Data Analysis

Discussion

Multiple Regression

Conclusion and Recommendation

Figure 1.3: Research Design

Although there are numerous factors to be considered when choosing an appropriate research methodology, [18] stated that the selection of the method depend entirely upon the topic to be researched and specific research questions to be answered. Thus they added that when a researcher is trying to understand and explain a phenomena rather than search for external cause, a qualitative approach is more appropriate. In addition to that, another researcher, [19] Salkind (2003) further confirm that a qualitative research is more preferable research to choose because there were no statistical analyses involved. However, in contrast, when questions related to the relationship between variables is involved and answering a research questions with some theoretical, previous research supports a quantitative approach is more appropriate [20]. Therefore this study proceeds with a quantitative approach.

The target population in this study consists of all women within the age of working group who commute to work by bus service.

These women live in Malaysian capital area with a 100% scale of the urbanization process and a high population density, namely Kuala Lumpur. Hence, the samples were randomly selected accordingly to the criteria set up in quota sampling from those major urban areas selected. Based on the table proposed by [15] on the sample size for any given population, a total sample of 384 is recommended. Thus this study adopt this approach and use 384 as a total sample size.. During the actual data collection, a personally administered questionnaire technique was used because through this technique, doubt can be clarified at that particular point and the response rate is almost 98% ensured [16].

In order to produce a fear detector model, a hierarchical regression analysis was used. Regression analysis is a asset of statistical procedures used to predict and explain the value of dependent variable based on the value of one or more independent variables [17]. They also reported that there are two types of regression analysis that a researcher can choose in testing. When the independent variable is more than one, a multiple or hierarchical linear regression analysis is deem suitable. This is due to the fact that data for the dependent variable is continuous in nature whereas the independent variable s area continuous or discrete in nature.

5.   Results

The significant regression model indicates the effect of bus service and infrastructure towards the dependent variables (level of fear). The main purpose of hierarchical regression model is to look at the effect of all independent variables namely bus service, infrastructure and social environment towards the level of fear among female commuters.This section will use a regression analysis (hierarchal) to explore the relationship between Bus Service, Infrastructure, Social Environment and Fear of Crime. The relationship expected is explored using the hypothesis as below:-

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H_1: There is a relationship between bus service characteristics and infrastructure in relation to fear of crime.

H_2: There is a relationship between bus service characteristics and social environment in relation to fear of crime.

H_3: There is a relationship between infrastructure and social environment in relation to fear of crime.

A linear regression model adopted in this study is given in equation 1.1.

$$Y = \alpha + B_1X_1 + B_2X_2 + B_3X_3 + \varepsilon$$
(1.1)

Where,

X_1	=	Bus Service
X_2	=	Infrastructure
X_3	=	Social environment
α	=	Constant
B_1-B_3	=Regression coefficients computed by the model	
Y	=	Fear of Crime
ε	=	Error not captured by the model

To further strengthen the hypothesis acceptance level based on the significant level, a few descriptive analysis was tabulated through Table 1.1 and Table 1.2

Table 1.1: Regression Analysis Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.501[a]	0.251	0.248	0.26553
2	0.502[b]	0.252	0.247	0.26565
3	0.504[c]	0.254	0.246	0.26584

a. Predictors: (Constant), Bus Service
b. Predictors: (Constant), Bus Service, Infrastructure
c. Predictors: (Constant), Bus Service, Infrastructure, Social Environment

Table 1.1 shows the percent of variability in the dependent variable that can be accounted for by all the predictors together (that's the interpretation of R-square). The change in R -square is a way to evaluate how much predictive power was added to the model by the addition of another variable. In this case, the % of variability accounted the feeling of fear for went up from 24.8% to 24.6% as the predictors were added.

Table 1.2 shows that all predictors were statistically significant. The entire three model predicted scores on the dependent variable shows statistically significant degree. The significant column for p-values, which need to be below .05 indicate a statistically significant result for the model. In this case, all set of predictors was significant. If the predictors had been statistically significant, these betas (B) are the weights that could be used by multiplying each individual person's scores on the independent variables by, in order to obtain that individual's predicted score on the dependent variable (fear of crime).

Table 1.2: Coefficient Value for Regression Analysis

Model		Sum of Squares	df	Men Square	F	Sig.
1	Regression	7.309	1	7.309	103.660	0.000[b]
	Residual	21.857	310	0.071		
	Total	29.166	311			
2	Regression	7.360	2	3.680	52.144	0.000[c]
	Residual	21.806	309	0.071		
	Total	29.166	311			
3	Regression	7.400	3	2.467	34.902	0.000[d]
	Residual	21.766	308	0.071		
	Total	29.166	311			

a. Predictors: (Constant), Social Environment, Infrastructure, Bus Service,

b. Dependent Variable: Level of Fear

From Table 1.1 and Table 1,2, a significant relationship exist between the independent and the dependent variable. This indicates that feeling of fear where fear is measured by percentage of feeling fear and bus service and infrastructure is measured by percentage of dissatisfaction and social environment is measured through feeling of worried. Thus, from the results it can be clearly seen that all independent variables affected the feeling of fear indication with bus service being the most influential and social environment being the least. These results attempt to answer the fourth research question on public transport service, infrastructure and social environment interaction with one another in relation to fear of crime indication.

Table 1.3: Regression Analysis (Hierarchical) Between Independent Variable and Fear

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.912	0.060		82.531	0.000
	Bus Service	-0.246	0.024	-0.501	-10.181	0.000
2	(Constant)	4.950	0.074		66.661	0.000
	Bus Service	-0.219	0.040	-0.446	-5.475	0.000
	Infrastructure	-0.045	0.053	-0.069	-0.849	0.397
3	(Constant)	4.908	0.093		52.615	0.000
	Bus Service	-0.235	0.045	-0.478	-5.180	0.000
	Infrastructure	-0.036	0.055	-0.055	-0.656	0.512
	Social Environment	0.022	0.030	0.044	0.752	0.453

a. Dependent Variable: Fear of Crime

From the analysis of the regression model 1, the following equation was obtained to further explain the dependent variable of the study which is fear indication among female commuters as a result of constant (α), plus a coefficient (b) times the value of independent variable such as Bus service (X_1), Infrastructure (X_2) and Social Environment (X_3), plus error. The completed equation can be referred to equation 1.2. The model indicates the significance contribution of each variable towards the level of fear indication among female commuters. Based on the result tabulated in Table 1.3, only bus service characteristics had a significant value.

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Table 1.4 : Summary of Regression Analysis (Hierarchal) Between Significant variable (Bus service) and Fear of Crime

Variable (X)	B	Beta (β)	T	Sig. T	R^2	Contribution (%)
Expected Service Quality	4.912	-0.501	-10.181	0.000	0.251	25.1
Constant	0.912		82.531	0.000		

Regression analysis in Table 1.4 shows the multiple regression analysis between the independent variables and Fear of Crime. From the analysis, only Bus Service has significant contribution towards the Fear of Crime. The analysis is significant based on the ANOVA table ($F=103.660, p<0.05$). Total contribution of the Bus Service towards the Fear of Crime is 25.1%. When Bus Service satisfaction level increases by 1 units, Fear of Crime will reduce by 0.501 units. The model equation for relationship between Bus Service and Fear of Crime is given in Equation 1.2.

From the equation 4.2 the score of fear level could be measured by multiplying the score on the level of satisfaction indication by looking at the regression coefficient computed by the model on bus service.

$$\gamma = \alpha + B_1X_1 + \varepsilon$$

(1.2)

$Y = 132.150 - 0.173X_1 - 0.163X_2 - 0.74X_3$ $Y = 132.150 + 1.627 - .243X_1 - .216X_2 - .116X_3$
$Y = 132.150 - .243X_1 - .216X_2 - .116X_3$

Equation 1.2 shows the effect of the independent variable (bus service) towards the dependent variable (fear of crime).

X_1	=	Bus Service
	=	1 (Very Dissatisfied)
α	=	0.912
B_1	=	-0.501
R Square	=	0.251
Std error	=	0.266
Y	=	Fear of Crime

Result from the descriptive analysis from ANOVA and Regression analysis indicated that:
Thus the final results of the significant model will be as follows:

X_1	=	Bus Service
α	=	Constant
B_1	=	Regression coefficients computed by the model
R Square	=	0.251
Std error	=	0.266
Y	=	Fear of Crime
ε	=	Error not captured by the model

$$Y = \alpha + B_1X_1 + \varepsilon$$

$$Y = 0.912 - 0.501X_1 + 0.266$$

6.0 Discussion

The model were evaluated based on two extreme condition. One with good condition and worst condition. From there, then level of fear was formulated.

6.1 Evaluation of Model 1 (All are in good condition)

A simulation of regression model was run based on the assumption that all attributes measured in this study are in good condition. For example:

X_1 = Bus Service (scale 1= very dissatisfied, 5= very satisfied)

However from the result of regression analysis, only bus service have significant contribution towards the fear of crime. Thus

model were simulate with a condition of bus service characteristics only where,

X_1	=	Bus Service
	=	5 (Very Satisfied)
α	=	0.912
B_1	=	-0.501
R Square	=	0.251
Std error	=	0.266
Y	=	Fear of Crime

Final result of the model given all condition is good is as follows:

$$Y = \alpha + B_1 X_1 + \varepsilon$$

$$Y = 0.912 - 0.501\,(5) + 0.266$$

$$Y = -1.327$$

The result indicated that when the level of satisfaction is increase to the scale of 5 (very satisfied), the fear level indication will decrease to 1 unit (not fear at all).

6.2 Evaluation of Model 11 (Worst Condition)

Assuming all attributes measured in this study are in worst condition such as :

X_1 = Bus Service (scale 1 = very dissatisfied). Therefore the following model were simulate with a condition if

Final result of the model given worst situation is as follows:

$$Y = \alpha + B_1 X_1 + \varepsilon$$

$$Y = 0.912 - 0.501\,(1) + 0.26$$

$$Y = 0.677$$

The result indicated that when the level of satisfaction is decrease to the scale of 1 (very dissatisfied), the fear level indication will increase to a higher by 6 unit (very fear).

It can be clearly seen that the fear level shows an increase by 6 units especially when female commuters indicated the worst situation for each of the attributes measured in this study. This included bus service that female commuters used and experienced every day that created a sense of worry while commuting to their workplace.

7.0 Conclusion and Recommendation

The following conclusions can be drawn from the present study of female commuters and the level of fear where factors that significantly affect level of fear among female have been identified as the satisfaction level of bus service, infrastructure and social environment. In an attempt to investigate the extend of influence between the different satisfactory level and the level of fear indication, a simulation model of safe environment have been developed where the model measures the direct effect of bus service, infrastructure and social environment on level of fear indication while travelling. This model explains that the dependent variable (fear) is influenced by the satisfaction of each independent variable (bus service, infrastructure and social environment).It can also be concluded that female commuters travelling on the stage bus services tend to indicated a higher level of fear when they rated a higher level of dissatisfaction

X_1	=	Bus Service
	=	1 (Very Dissatisfied)
α	=	0.912
B_1	=	-0.501
R Square	=	0.251
Std error	=	0.266
Y	=	Fear of Crime

towards all measured attributes. Failure to increase their satisfaction level will lead to a higher level of fear among female commuters. Thus it can be sum up that the level of fear towards crime could be reduce by increasing the satisfaction level of the current female commuters.

The model suggest that, if all condition is good, the level of fear towards crime could be reduce among these commuters who had no choice but to depend on everyday public transport for commuting to work purpose. Improvement on the current operating bus service and infrastructure provision is needed to reduce the problem of unsafe indication from the passengers. The important elements that should be taken into consideration while planning include the characteristics of the population and its needs as well as fears, the characteristics of setting (location of bus stop, surrounding environment and standard facilities such as lighting, the design of the bus stop and proper pedestrian walkways) and desired type of activity in public spaces.

Acknowledgments

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