# THE EFFECT OF EXTERNAL DISTURBANCE TO CAR DRIVER AND MOTORCYCLE RIDER BEHAVIOUR

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## ABSTRACT

*Car driver and motorcycle rider behaviour might be affected by external disturbances. These include the behaviour of other driver/ rider, the behaviour of pedestrian, the road condition, the existence of outdoor advertisement, people activities on road and surroundings, building lighting, etc. There were 100 respondents interviewed consist of university students, lecturers and employees. Both males and females were covered and both car drivers and motorcycle riders were covered. The questionnaire consists of social status (gender, age, marital status, residential status, health), economic status (monthly expenditure, education back ground, employment status), vehicle data (engine size and production year), driving/ riding skill (driving/ riding experience, driving/ riding license possession), driving/ riding habit (helmet/ safety belt use, equipment check), travel characteristics (daily driving/ riding distance/ time, daily departure and arrival time), risky beharioiur (exposure to traffic violation/ accident, etc), and 9 other questions regarding external disturbances. Covariance based SEM (Structural Equation Modeling) will be used to analyzed the effect of repondents socio- economic characteristics, driving/ riding skill/habit/risky behaviour, vehicle/ travel characteristics to their attitude towards external disturbance. A free Partial Least Square (PLS) software available on web called Smart-PLS was used.*

**Keywords:**

*External Disturbance, Car Driver Behaviour, Motorcycle Rider Behaviour, Structural Equation Modeling, Partial Least Square*

## 1. INTRODUCTION

Driving a car or riding a motorcycle has already been a multitasking activity [1]. Ones needs to concentrate in this kind of activity to ensure safe drive/ ride. Therefore any disturbance both internal or external disturbances should be minimized. Internal disturbance can be defined as disturbance caused by internal activities in the vehicle such as using mobile phone (initiate/ receive call, sending/ replying text, etc) as stated by [2], using other gadgets (observing map through GPS, using smartphone for various tasks, etc), operating audio visual equipments [3], engaged in internal activities with passengers [4], eating and drinking [5], etc. External disturbance can be defined as disturbance caused by activities/ things outside the vehicle such as behaviour of other driver/ rider, the behaviour of pedestrian, the road condition, the existence of outdoor advertisement, people activities on road and surroundings, building lighting, etc. In this paper the the effect of repondents socio economic characteristics, driving/ riding skill/habit/risky behaviour, vehicle/ travel characteristics to their attitude towards external disturbance will be discused.

## 2. PREVIOUS STUDIES

Reference [6] shows that older motorcycle riders check the equipment before the ride more frequent compare to the younger one. They stated that whealtier rider tend to involve in less traffic rule violation. They aso stated that helmet use was associated with other responsible behaviour such as bring vaid license on ride, involve in less traffic rule violation and low accident exposure.

According to [7] younger rider was more likely to involve in fatal accident. This is confirmed by [8] that stated older riders tend to conduct safe riding.

According to [9] law enforcement might increase helmet use. At the end, this increase will lead to less number of head injuries.

According to [10] higher rider education could increase posession of valid license. It also increase helmet use rate. According to [11] posession of license would improve riding performance.

According to [12] younger rider, lower road class and male rider tend to fall into low helmet use group. Meanwhile according to [13] law enforcement could decrease fatal and non-fatal injuries. Further they said that rider education and lower speed limit would decrease non-fatal injuries.

Reference [14] shows that less riding experience/ riding skills and poor license system woul increase accident risk. They also found that female rider tend to have less experience.

Reference [15] shows that younger female drivers with less experience and more speeding and parking offences tend to be more inattentive and more dangerous. Some of these characteristics confirming the finding of [16]. Meanwhile, [17] stated that younger and whealtier drivers with speeding and traffic rule violation history tend to involve in more accident.

Reference [18] shows that sreet lighting increase car speed, decrease driver concentration and decrease accident rate. Another road condition such as road segment homogenity might maintain car speed stability [19].

According to [20], driver stress might increase driving error and driving violation. Meanwhile, [21] stated that drivers with dangerous and speeding habit were usually young, whealty, less likely to use seat belt and involved in more traffic rule violation and accident. They also stated that experienced and well educated drivers tend to be less dangerous although driving in higher speed.

According to [22] , less ability in accident probability judgement, less concern, less worry and security and less emotional reactions formed more risky behahiour. Furthermore they stated that risky behaviour was reflected by unsafte driving and social pressure, speeding and traffic rule violation.

Reference [23] shows that driver who rarely use seat belt tend to involve in severe crash and severe injury. Meanwhile, according to [24] unbuckled caucasian drivers tend to involve in red light running.

Reference [25] shows that driver with more risky driving behaviour tend to conduct speeding and violate traffic rule. They also stated that risk perception was reflected by worry and concern.

Provocation by other road users might lead to speed acceleration by the provocated drivers [26]. However, male driver tend to accelarate faster [27].

According to [28] more speed limit violation was done by non seat belt user. Meanwhile, driver risky behaviour was usually stronger in less educated and less whealty communities [29]. According to [30] drivers with more traffic violation history tend to involve in crashes.

Higher education was related to higher safety belt use rate [31]. Moreover, older driver with higher job level and higher wealth level was related to higher safety belt use rate [32].

Variable message sign would increase driver alertness [33]. However, truck drivers utilized more time to read roadside displays [34].

Street level advertisement was attracting more driver attention compare to raised level advertisement [35]. In general, outside distractions tent to trigger more absence of hand on steering wheel and cause more lane wandering [5].

## 3. METHODOLOGY

There were 100 respondents interviewed consist of 73 university students, 12 university lecturers and 15 university employees. There were 66 males and 34 females. There were 49 car drivers and 51 motorcycle riders were covered.

Based mainly on the literature review with necessary modification, the questionnaire consists of :

- social status  (gender, age, marital status, residential status, health)
- economic status (monthly expenditure, education back ground, employment status)
- vehicle data (engine size and production year)
- driving/ riding skill (driving/ riding experience, driving/ riding license possession)
- driving/ riding habit (helmet/ safety belt use, equipment check)
- travel characteristics (daily driving/ riding distance/ time, daily departure and arrival time)
- risky beharioiur (exposure to traffic violation/ accident, etc)
- attitude towards external disturbances (include the behaviour of other driver/ rider, the behaviour of pedestrian, the road condition, the existence of outdoor advertisement, people activities on road and surroundings, building lighting, etc.).

Covariance based SEM (Structural Equation Modeling) was used to analyzed the effect of repondents socio- economic characteristics, driving/ riding skill/habit/risky behaviour, vehicle/ travel characteristics to their attitude towards  external disturbance. A free Partial Least Square (PLS) software available on web called Smart-PLS was used. Only indicators with standardized loading factor (SLF) equal and above 0.5 were considered.

Car models were separated from motorcycle models. During data inputting, for both models there were two methods, using limited ordinal scale and using widen ordinal scale (for example for data with wide range of values such as responden age, vehicle production year, etc). Therefore four models were produced. In this paper only visual model for widen ordinal scale will be presented due to the limited pages allowed. However the indicators with SLF≥0.5 were presented both for limited ordinal scale models and widen ordinal scala models.

## 4. RESULTS AND DISCUSSIONS

Figure 1 shows the full model for car with widen ordinal scale whilst Figure 2 shows the final model for motorcycle after all indicators with SLF<0.5 (including negative SLF's) removed. Figure 3 shows the full model for motorcycle with widen ordinal scale whilst Figure 4 shows the final model for motorcycle after all indicators with SLF<0.5 (including negative SLF's) removed.

Table 1 shows the summary of all indicators with SLF≥0.5 both in car and motorcycle models. The models consist of limited ordinal scale models and widen ordinal scale models. It can be seen that in car models all indicators reflect economic characteristics latent (education attainment, monthly expenses and job level), whilst in motorcycle model only job level was significant.

Marital status was a significant indicator forming social status in car and motorcycle widen ordinal scale models. In car and motorcycle limited ordinal scale models, age was the only significant indicator forming social status.

Except for car model with limited ordinal scale, in all other models, production year was the only indicator significantly forming vehicle characteristic latent. For all models, driving/ riding experience was the only significant indicator reflecting driving/ riding skill latent.
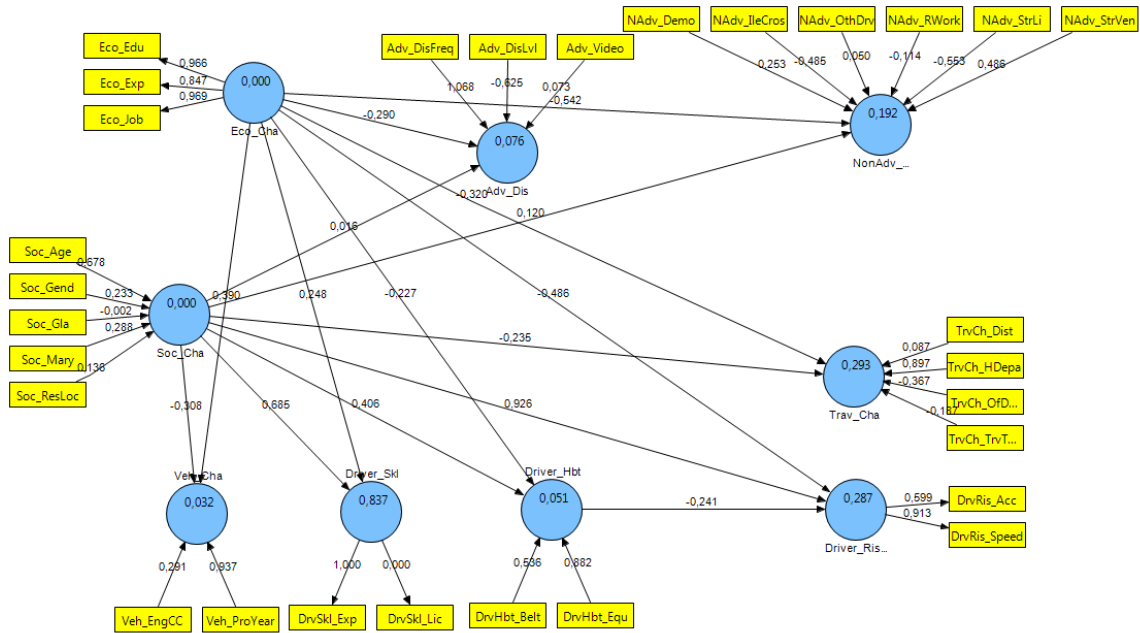


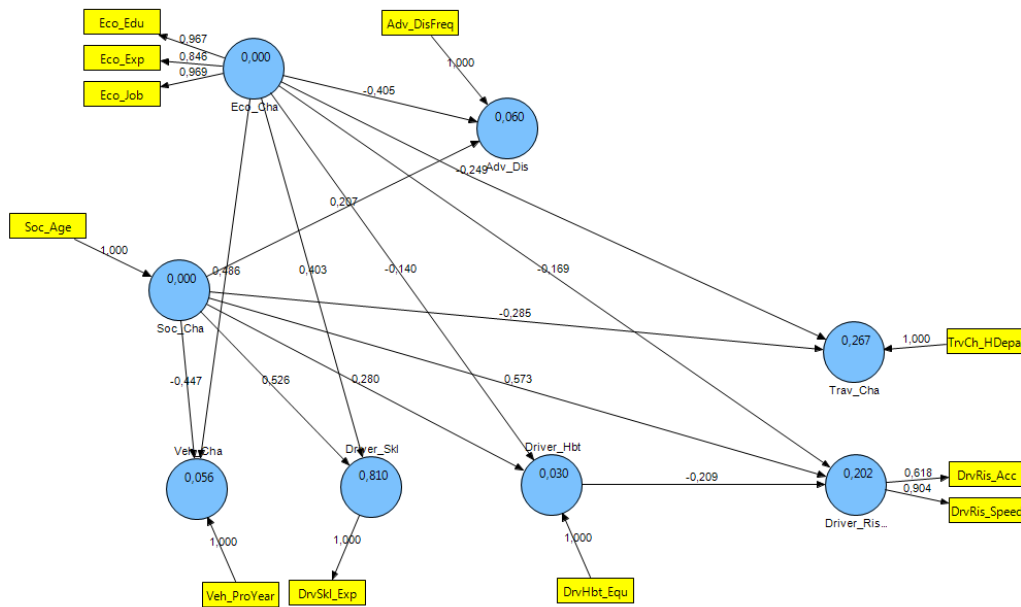Figure 1: Full Model for Car-Widen Ordinal Scale



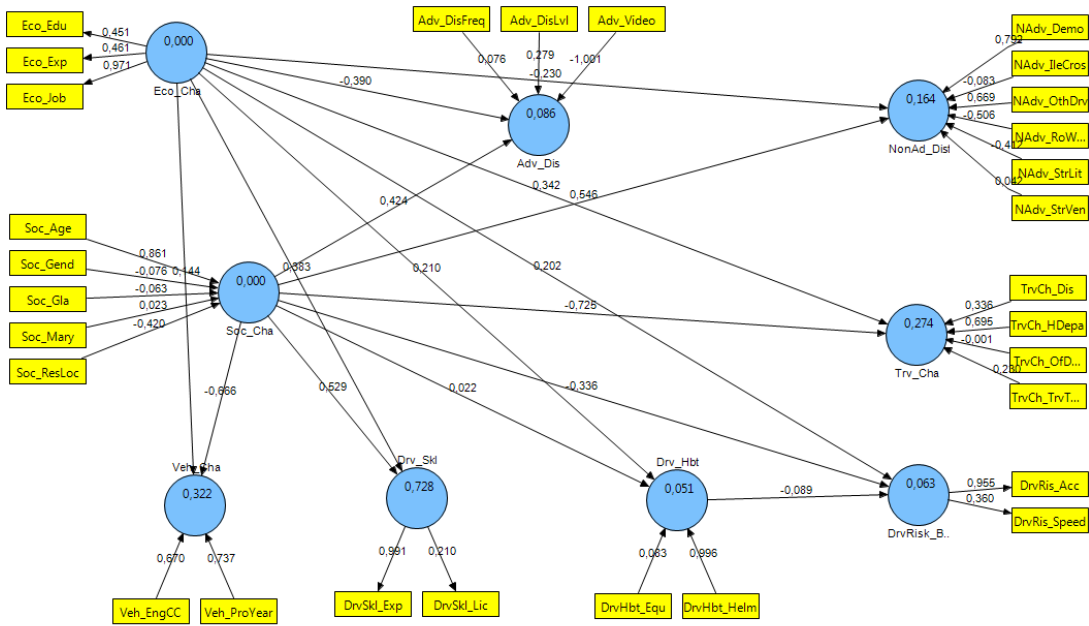Figure 2: Final Model for Car-Widen Ordinal Scale

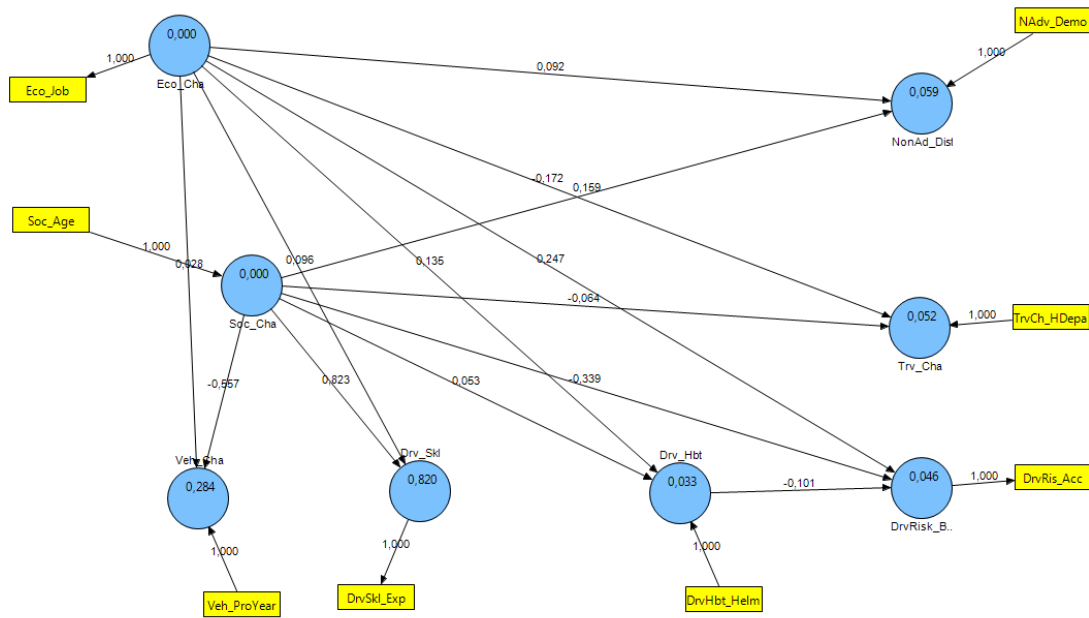Figure 3: Full Motorcycle Model-Widen Ordinal Scale



Figure 3: Final Motorcycle Model-Widen Ordinal Scale

For all car models, equipment check before driving was the only indicator siginificantly forming driving habit latent. For all motorcycle models, helmet use was the only indicator siginificantly forming driving habit latent.

For all widen ordinal scale models, accident involvement history was a significant indicator reflecting driver/ rider risky behaviour latent However in car model, driving in a speed morte than 100 km/hour was another significant indicator. Driving in a speed more than 100 km/hour was the only significant indicator reflecting car limited ordinal scale model.

For all models, departure time was the only significant indicator forming travel characteristic latent. For all car models, advertisement disturbance frequency was the only significant indicator forming advertisement external disturbance latent (there were no significant indicator for motorcycle models for this latent). For all motorcycle models, demonstration disturbance was the only significant indicator forming non-advertisement latent ((there were no significant indicator for car models for this latent).

In general, economic characteristic latent influence social characteristics, vehicle characteristics, driving skill, driving habit, driver/ rider risky behaviour, travel characteristics, advertisement disturbance and non-adverticement disturbance latents. Social characteristic latent influence all other latents except economic characteristics. Driving habit latent influence driver/ rider risky behaviours.

*Table 1: Summary of Indicator with SLF≥0.5*

| Latent Variable | Car-Limited Ordinal Scale | Car-Widen Ordinal Scale | Motorcycle-Limited Ordinal Scale | Motorcycle-Widen Ordinal Scale |
|---|---|---|---|---|
| **Economics Characteristics** | Education<br>Expenses<br>Job | Education<br>Expenses<br>Job | Job | Job |
| **Social Characteristics** | Marital Status | Age | Marital Status | Age |
| **Vehicle Characteristics** | - [1] | Production Year | Production Year | Production Year |
| **Drviving Skill** | Experience | Experience | Experience | Experience |
| **Driving Habit** | Equipments Check | Equipments Check | Helmet Use | Helmet Use |
| **Driver/ Rider Risky Behaviour** | Speeding | Speeding<br>Accident Involvement | - [1] | Accident Involvement |
| **Travel Characteristics** | Departure Time | Departure Time | Departure Time | Departure Time |
| **Advertisement Disturbance** | Frequency of Disturbance | Frequency of Disturbance | - [1] | - [1] |
| **Non-Advertisement Disturbance** | - [1] | - [1] | Demonstration | Demonstration |

1) SLF for all of the indicators in this latent are negative or below 0.5


## 7. CONCLUSION AND RECOMMENDATION

It can be concluded that except for economic characteristics latent and driver risky behaviour latent, all other latents have only single valid indicator to form or to reflect each of them. One of the possible cause was the use of non-standard questionnaire without statistical validation test. In further research this statistical validation test should be carried out.

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