PSYCHOLOGICAL FACTORS INFLUENCING BEHAVIORAL INTENTION OF PRIVATE CAR USE IN FUTURE WORK TRIPS

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Abstract: This study proposes an extension of the theory of planned behavior (TPB) to investigate whether psychological factors can potentially be predictors for the behavioral intention of private car use in future work trips. The study sample comprised 156 undergraduate students who were in their senior year and were expected to graduate in the next few months. A questionnaire survey was conducted to measure several psychological variables related to private car use for future work trips after graduation. Core constructs included subjective norm, attitude, and perceived behavioral control, with an addition of moral obligation. Based on structural equation modeling, we found subjective norm, attitude and moral obligation to be significant determinants for the behavioral intention. Contrary to the TPB, the perceived behavioral control was not found to be a statistically significant factor influencing the intention of private car use in future work trips. Practical implementations of the results are discussed.

Key Words: Psychological Factors, Future Car Use, Theory of Planned Behavior

1. INTRODUCTION

Similar to other developing Asian cities, Bangkok has experienced a surge in motorization tendency. The total number of registered vehicles fell in the range of 5 to 6 million in 2006, with an average annual increase of nearly 700,000 new vehicles from 2003 to 2006 (DLT, 2007). Despite its inevitably detrimental effects in terms of traffic congestion and environmental pollution, the use of private car is still appealing to general public and is somewhat regarded as an acceptable mode of transportation. According to the Office of the Transport and Traffic Policy and Planning of the Ministry of Transport (2005), the share of public transportation in Bangkok Metropolitan Administration (BMA) will remain somewhat constant at least within the next 15 years at nearly 50 percent of the total home-based-work (HBW) trips in spite of the increasing attractiveness of public transport mode under the advent of new electric train lines in the near future.

Given the aforementioned issues, it is thus necessary to investigate plausible measures that could control car use demand. One approach to reduce the demand of car use is to utilize travel demand management (TDM) or mobility management (MM) measures. Sometimes called structural methods, the TDM measures typically require legal and economic policies (Gärling and Fujii, 2006). Another approach can be referred to psychological methods, which focus on changing travel behavior through modifying psychological factors such as beliefs, attitudes, and values or norms. It has been proved in the literature that the latter approach can also successfully lead to travel behavior modification (See, for example, Fujii and Gärling,
2005; Fujii and Taniguchi, 2005). Such psychological methods have not been implemented in TDM, but they have been sometimes categorized as MM measures.

In Thailand, TDM measures have been studied to some extent (see, for example, Bhattacharjee et al., 1997); however, there is still a lack on the study of psychological methods in MM. According to attitude theories (Fishbein and Ajzen, 1975), the behavioral intention was considered to be an immediate determinant of behavior; therefore, changing those factors that directly predict behavioral intentions can be potentially expected to exert certain impacts on actual behavior. By targeting significant predictors of the behavioral intention of car use in future work trips, transportation engineers and planners can probably persuade potential commuters to change their future commuting behavior from private car use to a more sustainable transportation modes such as public transport.

The Theory of Planned Behavior (TPB) is regarded as one of the psychological theories that have been applied in travel behavior research in predicting travel behavior. Developed based on the former Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), TPB postulates that people’s behavior can be derived from their intentions, which in turn can be explained by people’s attitudes towards the behavior, their subjective norm, and their perceived behavioral control (Ajzen, 1991). In such case, attitude refers to beliefs about the degree to which the outcomes are evaluated as positive or negative, whereas subjective norm indicates beliefs about normative expectations of others as well as motivation to comply with these expectations. Perceived behavioral control can be defined as the perceived ease or difficulty of performing a behavior. This factor is assumed to reflect past experience and anticipated impediments of respondents in conducting a behavior (Ajzen, 1988). According to TPB, the stronger intention to perform a behavior is generally associated with the more favorable the attitude and subjective norm towards the behavior and the greater the perceived behavioral control.

Literature review shows a variety of applications of TPB in transportation and traffic fields. For instance, Elliott et al. (2005) conducted a study to identify potential beliefs affecting drivers’ intention to comply with speed limits. Along a similar line of research, Warner and Åberg (2006) applied the TPB to predict drivers’ speeding behavior. It was found that attitudes toward speeding, subjective norm, and perceived behavioral control were significant determinants of self-reported speeding. In Vietnam, Tuan (2006) investigated undesirable motorcycling behaviors such as speeding, risky overtaking, red light running. Two main constructs, i.e. habit formulation and intentions, were found from structural equation models of TPB items as the most significant factors for unsafe driving behaviors.

Some psychological studies in the literature were directly related to travel mode choice investigation. Steg et al. (2001), for instance, incorporated motivational factors such as attitudes and preferences to develop a car-use forecasting model. Results showed that car use can be better explained by taking these variables into account. Another mode choice study was conducted by Thøgersen (2006). Based on the structural equation models of panel data, the author investigated repetitive travel mode choices and concluded that current attitudes of car users were inconsequential. On the other hand, the use of public transport was influenced by attitudes, beliefs, and car ownership.

In Asian countries, Tan et al. (2006) explored psychological beliefs underpinning mode choice selection in Japan, Thailand, China, Vietnam, Indonesia, and the Philippines. It was found through multinomial logit analysis that generally attitudinal variables about car in terms of
symbolic affective, instrumental and social orderliness were all significant determinants of behavioral intention of commuting mode choice. In Bangkok, however, none of the three attitudinal variables for car was statistically significant in their study.

From the literature review, it can be seen that no past studies have been conducted to bond a link between psychological factors and the behavioral intention of private car use for future work trips. The study by Tan et al. (2006) merely considered attitudinal beliefs without investigating any other psychological variables that may prove to be of significance in determining the intention. As for Bangkok commuters, no implication was found due to the insignificance of the model. Thus, there is still a research gap to further explore the potential of psychological methods to predict behavioral intention, especially for commuters in a city with high level of motorization like Bangkok.

Figure 1 illustrates the proposed modeling framework. In the present study, we argued, through our empirical finding, that the behavioral intention of driving to work after graduation can be influenced by several psychological factors, not only three core variables according to the TPB but also other variables. Specifically, we hypothesized that moral obligation is also one of the important factors that could shape the degree of behavioral intention. In this case, the moral obligation is referred to the intention of an individual in trying to conform the action with social norms of good and bad. Individuals who possess higher moral obligation that driving to work after graduation could be problematic would be expected to have lower intention to conduct such a behavior. Additionally, in line with the so-called Norm Activation Theory (Schwarz, 1977), we hypothesized that the behavioral intention of driving to work after graduation can be influenced by the awareness of consequences through moral obligation.

Figure 1 Hypothesized model of casual structure related to driving to work after graduation

This paper is organized as follows. The first section provides an introductory background on the research. Key objectives and research framework are discussed. The following section details research methodology, including sample, questionnaire, and statistical analysis tools. Section 3 presents our estimation results and findings. The paper ends in Section 4 with discussion and conclusions.
2. METHODS

2.1 Sample
Participants in the present study were selected from senior (4th year) students at the Faculty of Engineering, Chulalongkorn University during November 2006 for a pilot survey and December 2006 for the main survey. In particular, the samples were stratified by departments where the students were enrolled. A total of 162 respondents returned the survey and 156 respondents were useable in the actual survey.

Among the respondents, the average age was 21 years and the average monthly allowance was 5,700 Baht (about US$160). Approximately 70 percent of the total respondents were male. Almost two-third of the respondents (64%) possessed a driving license, whereas more than 90 percent had at least one car in their household. Regarding the current mode of transportation to the university, it was found that 44 percent of the respondents regularly commuted by private cars, while the rest typically commuted to university by means of public transportation.

2.2 Questionnaire
The questionnaire contains two sections related to the present study. The first part of the questionnaire asked the respondents’ socio-economic information. The second part involved items for psychological measures designed to capture relevant variables with respect to complying with driving to work after graduation. All items used in the questionnaire were measured based on a seven-point Likert scale with “Totally Not Agree” and “Totally Agree” at the end points and “Indifferent/Don’t Know” at the midpoint. These measures can be summarized as followed:

2.2.1 Subjective Norm
Subjective norm was measured by asking respondents to rate four statements. Three statements were used to measure injunctive norms: “If I try to driving to work after graduation, my friend or my family would have no problem with it”; “My friend or my family thinks that I should drive to work after graduation”; and “My friend or family would agree with my driving to work after graduation.” Additionally, another statement, i.e. “Most of my friends will drive to work after graduation” was taken as a measure of descriptive norms.

2.2.2 Attitude
To measure attitudes, respondents were asked to rate two statements: “I prefer driving to work after graduation” and “I have a good attitude towards driving to work after graduation”. The outcome was evaluated based on a seven-point Likert scale.

2.2.3 Belief
Two statements were used to measure respondents’ beliefs about driving to work after graduation: “Driving to work after graduation will make me look luxurious and will interest my friends” and “For me, driving to work after graduation will make my commute convenient”. The former statement refers to belief about symbolic and affective aspect of car, while the latter belief represents instrumental aspect of car. These two beliefs were commonly found to be significant factors in determining people’s attitudes in previous studies (see, for example, Steg, 2005; Van and Fujii, 2006).

2.2.4 Perceived Behavioral Control
Four statements were used to measure respondents’ perceived behavioral control. They are:
“After graduation, it is easy for me to drive to work”; “If I want, I can drive to work after graduation”; “Whether or not I drive to work after graduation is completely up to me”; and “The decision to drive to work after graduation is under my control.”

2.2.5 Moral Obligation
A single statement was used to gauge the moral obligation towards driving to work after graduation using a seven-point Likert scale: “In terms of morality, I feel that driving to work after graduation is not problematic.”

2.2.6 Awareness of Consequences
The awareness of negative consequences of car use was asked by two components, i.e. the awareness of consequences on the social and on the environment. The corresponding statements asked are: “I think that driving to work after graduation will harm other road users” and “I think that driving to work after graduation will have undesirable consequences to environment”. In the analysis, the answers were coded so that a lower number indicates stronger awareness of adverse consequences.

2.2.7 Behavioral Intention
Four statements were asked to evaluate respondents’ behavioral intention: “I will drive to work after graduation”; “I want to drive to work after graduation”; “After graduation, I will make an effort to drive to work” and “After graduation, I intend to drive to work.”

2.3 Statistical Analysis
In this paper, structural equation modeling (SEM) was used for statistical analysis. We investigated two set of structural equation models. The models to be tested in the first set (Model I) strictly followed the TPB concept. Therefore, under this setting we tested the following structural relationships:

H1: Respondents’ attitudes about using a car to work after graduation are positively related to the intention to drive to work after graduation
H2: Respondents’ subjective norm about using a car to work after graduation are positively related to the intention to drive to work after graduation
H3: Respondents’ perceived behavioral control about using a car to work after graduation are positively related to the intention to drive to work after graduation

In the second set of structural equation model (Model II), we extended Model I, taking into account additional psychological constructs such as the moral obligation, awareness of consequences, and beliefs. Thus, in addition to the above three structural relationships, we further hypothesized the following:

H4: Respondents’ awareness of consequences of using a car to work after graduation are negatively related to their moral obligation to drive to work after graduation
H5: Respondents’ beliefs are related to their attitudes about using a car to work after graduation
H6: Respondents’ moral obligation about using a car to work after graduation are positively related to the intention to drive to work after graduation

The linear structural relation (LISREL) 8.53 software (Jöreskog and Sörbom, 1993) was selected for structural equation modeling analysis. Several goodness-of-fit statistics were used in judging the fit and validity of the model. The Goodness-of-Fit Index (GFI) and the Root
Mean Square Error of Approximation (RMSEA) were evaluated as absolute fit measures. The Normed Fit Index (NFI) and the Comparative Fit Index (CFI) were taken as incremental fit indexes. As a rule of thumb, the cutoff value of 0.90 can be considered for GFI, NFI, and CFI, whereas the typical values of RMSEA are below 0.10 for most acceptable models (Hair et al., 2006), although RMSEA below 0.08 would indicate a good fit of the models.

3. RESULTS

3.1 Psychological Factors
The homogeneity of the items within the dimensions measuring each psychological factor was evaluated by means of the Cronbach’s alpha coefficients. Typically, the values of 0.60 to 0.70 are regarded as the lower limit of acceptability (Hair et al., 2006). From Table 1, it can be observed that the scales for subjective norm, attitude, perceived behavioral control, and behavioral intention can be used for the analysis with acceptable reliability. The corresponding mean and standard deviation values from the seven-point Likert scale (1-7) for each psychological variable are also shown in Table 1.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Number of items</th>
<th>Cronbach’s Alpha (α)</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SN: Subjective Norm</td>
<td>4</td>
<td>0.850</td>
<td>5.31</td>
<td>1.08</td>
</tr>
<tr>
<td>A: Attitude</td>
<td>2</td>
<td>0.848</td>
<td>5.03</td>
<td>1.41</td>
</tr>
<tr>
<td>B1: Belief on symbolic and affective aspect of car</td>
<td>1</td>
<td>-</td>
<td>3.49</td>
<td>1.70</td>
</tr>
<tr>
<td>B2: Belief on instrumental aspect of car</td>
<td>1</td>
<td>-</td>
<td>5.54</td>
<td>1.41</td>
</tr>
<tr>
<td>PBC: Perceived Behavioral Control</td>
<td>4</td>
<td>0.805</td>
<td>5.39</td>
<td>1.20</td>
</tr>
<tr>
<td>MO: Moral Obligation</td>
<td>1</td>
<td>-</td>
<td>4.17</td>
<td>1.558</td>
</tr>
<tr>
<td>AC1: Awareness of Consequences on social</td>
<td>1</td>
<td>-</td>
<td>4.72</td>
<td>1.633</td>
</tr>
<tr>
<td>AC2: Awareness of Consequences on environment</td>
<td>1</td>
<td>-</td>
<td>4.53</td>
<td>1.580</td>
</tr>
<tr>
<td>I: Behavioral Intention</td>
<td>4</td>
<td>0.948</td>
<td>4.56</td>
<td>1.47</td>
</tr>
</tbody>
</table>

The correlation for the constructs postulated to directly or indirectly influence the behavioral intention is presented in Table 2. Results show that all psychological constructs were correlated significantly, with an exception of two constructs for the awareness of consequences.
### Table 2 Construct Correlation Matrix

<table>
<thead>
<tr>
<th>Constructs</th>
<th>MO</th>
<th>SN</th>
<th>A</th>
<th>PBC</th>
<th>I</th>
<th>B1</th>
<th>B2</th>
<th>AC1</th>
<th>AC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MO</td>
<td>1.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SN</td>
<td>0.43**</td>
<td>1.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0.46**</td>
<td>0.62**</td>
<td>1.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBC</td>
<td>0.28**</td>
<td>0.65**</td>
<td>0.54**</td>
<td>1.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>0.54**</td>
<td>0.67**</td>
<td>0.87**</td>
<td>0.51**</td>
<td>1.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>0.29**</td>
<td>0.09</td>
<td>0.26**</td>
<td>-0.05</td>
<td>0.24**</td>
<td>1.00**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>0.38**</td>
<td>0.42**</td>
<td>0.60**</td>
<td>0.43**</td>
<td>0.57**</td>
<td>0.21**</td>
<td>1.00**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC1</td>
<td>-0.10</td>
<td>0.03</td>
<td>0.11</td>
<td>-0.03</td>
<td>0.05</td>
<td>-0.02</td>
<td>-0.10</td>
<td>1.00**</td>
<td></td>
</tr>
<tr>
<td>AC2</td>
<td>-0.03</td>
<td>0.06</td>
<td>0.13</td>
<td>-0.13</td>
<td>0.05</td>
<td>-0.10</td>
<td>-0.04</td>
<td>0.73**</td>
<td>1.00**</td>
</tr>
</tbody>
</table>

Note: *p < 0.05 and **p < 0.01.

### 3.2 Structural Equation Modeling

#### 3.2.1 Model I

In the first model, we hypothesized that the behavioral intention of driving to work after graduation could be explained by three first-order factors of attitudes, subjective norm, and perceived behavioral control. Figure 2 shows the structural model with standardized path coefficients. Overall, this model yielded a $\chi^2$ value of 144.71 with 71 degrees of freedom and accounted for 79 percent of the variance in the behavioral intention. The standardized direct effects on the behavioral intention were 0.25 for subjective norm, 0.74 for attitudes, and -0.05 for perceived behavioral control. It should be noted that the perceived behavioral control did not found here to be a statistically significant determinant for behavioral intention of driving to work after graduation, while the other two variables were found statistically significant at least at 99% level.

A review of the goodness-of-fit statistics shows that the model represents a marginally good fit to the data. Specifically, the RMSEA value of 0.082 was lower than the upper limit of 0.10 and the GFI of 0.88 was slightly lower than the cutoff value of 0.90. The chi-square/d.f. of 2.04 was well below the recommended value of 3.00. The NFI and CFI values were better than the cutoff value of 0.90.
3.2.2 Model II
In this model the behavioral intention of driving to work after graduation was represented as a multidimensional construct of attitudes, subjective norm, perceived behavioral control, and moral obligation. Additionally, the awareness of consequences and beliefs were postulated as determinants of moral obligation and attitudes, respectively. Figure 3 presents the results of LISREL analysis. It should be noted that except those observed variables in the behavioral intention, the remaining measurement models, while being statistically significant, were not explicitly shown in Figure 3 for the sake of clarity of presentation.

The estimation of Model II yielded an overall $\chi^2$ value of 291.66 with 134 degrees of freedom. From the model, two variables for the awareness of consequences were not found significant for moral obligation. However, two constructs for beliefs were statistically significant in determining attitudes. These beliefs can account for 37 percent of the variance in attitudes. Consistent to the previous model, the perceived behavioral control was not statistically significant as a determinant of the behavioral intention of driving to work after graduation. The other three latent constructs, i.e. subjective norm, attitudes, and moral obligation were all significant at the 99.9% level. The standardized direct effects on behavioral intention were 0.29 for subjective norm, 0.73 for attitudes, and -0.02 for perceived behavioral control.

Note: # Value fixed at 1.0, *p<0.05, **p<0.01, ***p<0.001

Figure 2 Results of LISREL Analysis for Model I
($\chi^2 = 144.71$, d.f. = 71, RMSEA = 0.082, GFI = 0.88, NFI = 0.96, CFI = 0.98)
behavioral control, and 0.19 for moral obligation. These four core constructs accounted for 74 percent of the variance in the intention of driving to work after graduation.

![Diagram showing the relationships between constructs](image)

Note: # Value fixed at 1.0, *p<0.05, **p<0.01, ***p<0.001

Figure 3 Results of LISREL Analysis for Model II
($\chi^2 = 291.66$, d.f. = 134, RMSEA = 0.087, GFI = 0.83, NFI = 0.93, CFI = 0.96)

It can be observed from the results that the model fitted the data moderately well. The chi-square/d.f. of 2.18 was well below the recommended value of 3.00. Although the GFI was slightly lower than the cutoff value of 0.90 and the RMSEA was marginally higher than 0.08, the NFI and CFI values were all above the recommended values of 0.90.

4. DISCUSSION AND CONCLUSIONS

Results from the structural equation models revealed that the behavioral intention of driving to work after graduation was significantly influenced by attitudes, subjective norm, and moral obligation. The perceived behavioral control, however, did not significantly influence the behavioral intention in both models. There are several points to be noted from our findings. First, although the TPB has been used to examine behaviors in several areas, it can be seen that our empirical finding did not fully support all core latent variables of attitudes, subjective norm, and perceived behavioral control, as postulated in the TPB. The reason that the perceived behavioral control was not significant may be due to the fact that future behavior of driving to work of Bangkok’s respondents would not depend on how easy or difficult it is to
use a car. In other words, for decision to use car for future work trips, Bangkok’s respondents did not take their perceptions of the ability to drive into account. Similar results were reported in some past studies (e.g. Taniguchi (2004), who tested psychological factors in forming behavioral intention of behavior change, and Tuan (2006) who applied TPB for undesirable behaviors of motorists).

Secondly, the effect of attitudes was the most prominent for the behavioral intention of driving to work after graduation. Moreover, the determinants of attitudes, which in this case consisted of the beliefs on symbolic and instrumental aspects of car, were also found to be of statistical significance. Consequently, it can be implied that intervention of attitudes would be probably the most effective way in changing the behavioral intention of driving to work after graduation. One potential approach can be done by means of an educational campaign aimed at changing beliefs on the symbolic, affective, and instrumental of cars, and at the same time, promoting the positive beliefs of public transport. Such an approach, commonly known as travel feedback program, has been conducted in Japan and other countries (see, for example, Fujii and Taniguchi, 2005) but yet to be done in Thailand.

This study showed that the behavioral intention of driving to work after graduation was also influenced by the moral obligation. Increasing the level of moral obligation regarding car use may be plausible to reduce car use in the future. In theory, activating the awareness of consequences could change travel behavior, since the awareness of consequences could change moral obligation and the moral obligation could, in turn, change behavioral intention. Such a notion was outlined in the Norm Activation Theory (Schwarz, 1977), which emphasized the role of awareness of adverse consequences in activating the moral obligation of an individual. Nevertheless, our finding indicated that the intention of driving to work after graduation may not be encouraged by altruistic motivation like the awareness of consequences. This result implies that the moral obligation of Thai students to commute by car after graduation was not related to their awareness of consequences on negative impacts of car use on other road users as well as on the environment. In the future work, it is called for to investigate determinants of moral obligation for commuting by car while considering other types of awareness of consequence. Such an investigation is expected to provide other psychological targets addressing mobility management issues.

In conclusion, the present study demonstrated a promising result that adapting communicative transportation measures in MM might be possible in Bangkok. Such strategies should be practical and aimed at changing attitudes, subjective norm, and moral obligation. To the authors’ knowledge, this study was among the early studies regarding psychological factors that could affect travel behavior for Bangkok’s commuters. Several issues could be improved in future research. The actual behavior of driving to work after graduation is yet to be investigated. It is not the intention of the present study to explore the intention-behavior consistency; however, the collected data would provide a sound basis for future study on this matter and another wave of data collection from the same respondents would be called for. Lastly, the influence of habit on human behavior is another important issue. It was argued in the past study that habit car user may be more resistance to change of travel mode (Bamberg et al., 2003). Thus, in the future study, the incorporation of habit variables would be valuable.
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