

THE RELATIONSHIP OF SOCIO- DEMOGRAPHIC, ATTITUDE, AND TRAVEL MODE CHOICE : A PARTIAL LEAST SQUARE APPROACH

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THE RELATIONSHIP OF SOCIO-DEMOGRAPHIC, ATTITUDE, AND TRAVEL MODE CHOICE : A PARTIAL LEAST SQUARE APPROACH

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Abstract

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The purpose of the present study is to understand the relationship between socio-demographic, attitude and mode choice behavior. Sample of 209 respondents was collected through questionnaires for a week period. Structural Equation Modeling using Partial Least Square approach was utilized to hypothesis testing. This study proved that the socio-demographic characteristics (age and car ownership) were positively and significantly related to attitudes, but family size has negatively effect. Socio-demographic characteristics (age and car ownership) as well as attitudes were positively and significantly related to travel mode choice. As the dominant factor affecting the mode choice, attitudes on cost, accessibility, safety and comfortability of transportation modes are clearly a major consideration in the selection of modes of transportation. Therefore, as an effort to decrease the use of private vehicles (especially private cars), four aspects that need to be fixed are the cost, accessibility, safety and comfortability in public transportation, because those factors are the major concern for private car users based on research results.

Keywords : socio-demographics, attitude, travel mode choice

1. Introduction

As a developing country, Indonesia has become one of the countries that have the largest number of vehicles in the world. As is known, the growing number of motor vehicles (cars and motorcycles) in Indonesia in 2012 reached 94.37 million motor vehicles, whereas cars and motorcycles with an average of 10.54% growth per year in the period 1987 – 2012 (BPS, 2014). The high rate of growth, on one side has a positive effect on economic, on the other hand, it increases the fuel consumption which in turn has implications for the amount of subsidies that weigh on state budget of revenue and costs, so that the development of mass transport modes is a challenge that must be met in order to overcome these transportation problems.

Mass transport sector in Indonesia is one of the problems in recent years become a serious concern of government. The complexity of problems ranging from poor public transport services which then have implications for the use of private vehicles. This tendency to use private vehicles has caused a new problem

that is traffic jam in most major cities in Indonesia. Therefore, the latest empirical explanation is needed to obtain an overview of the process of selecting a mode of transportation.

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Researchers in the field of transport mode choice behavior or the way in decades have attempted to provide a better explanation for the complexity of the transport mode selection and determinants. From the theoretical side, various research has put a wider variety of information relating to individuals, including socio-demographics, attitudes, preferences and intentions, perceptions and opinions, emotional state and motivation, personality traits and subjective norm, perceived responsibility and control, political, habits, lifestyle, situational variables such as health conditions and various other factors become determinants of travel mode choice.

Relationship between socio-demographic characteristics and attitude in marketing research still provide mixed results. Wu (2003) reported that consumer characteristics are important influence factors on consumer attitudes and online shopping decisions. Previously, Moon et al., (1999) also reported that consumers' overall has a significant effect on attitude toward peanuts and consumption behavior. Some recent studies show different results, such as 16 Antonopoulou et al., (2009) in marketing showed that attitudes towards GM foods are not affected by socio-demographic characteristics. Aluri and Palakurthi (2011) examines the socio-demographics 11 (gender, income, and education levels) indicate no difference in the attitudes and intentions of consumers to use RFIDs. Nandamuri and Gowthami (2012) found that out of the five demographic factors tested, occupation and income emerged as the strongest determinants of attitude.

Besides influenced by attitude, study of the travel mode choice also using socio-demographic variables as an important issue. 2 A large number of papers studied the impact of socio-demographic variables on travel behavior and found some significant relationships between travel behavior and variables such as age, education, income, car ownership, and family size. Kattiyapornpong and 17 Miller (2009) found that age, income and life stage has a significant differential and interactive effects on travel behavior. Collantes dan 20 Mokhtarian (2007) use the personal factors that determine the subjective assessment of mobility such as personality traits, attitudes related to travel, lifestyle characteristics, and affinity for travel.

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The purpose of the study is to explore the influence of demographic factors (age, education, income, car ownership, and family size) on attitudes and mode selection (public mass transport, motorcycle, and private car). Empirical research on the role of socio-demographics as a determinant of the level of interest (attitude) in Indonesia in terms of the selection of a mode of transportation is still very limited. This study may

be useful to explain things that are specific to the community in the selection of modes of transportation in urban areas in performing daily activities by taking into account travel patterns and travel time is done. Specificity results obtained for further expected to provide a role or input to the selection of research in the field of transportation modes or related topics others, and also in planning in the field of transportation, especially for settings in urban transport management

2. Conceptual Theory And Hypotheses

Conceptual framework begins by presenting a general theoretical framework related to decision-making in mode choice. Model prepared by placing socio-demographic factors that influence attitudes (Moon et al., 1999; Wu, 2003; Sun et al., 2011; Antonopoulou et al., 2009; Aluri and Palakurthi, 2011;). Furthermore, attitudes are used as antecedents mode selection (Garling et al., 1998; Postorino and Versaci, 2008; Mann and Abraham, 2006; Domarchi et al., 2008; Frank et al., 2008).

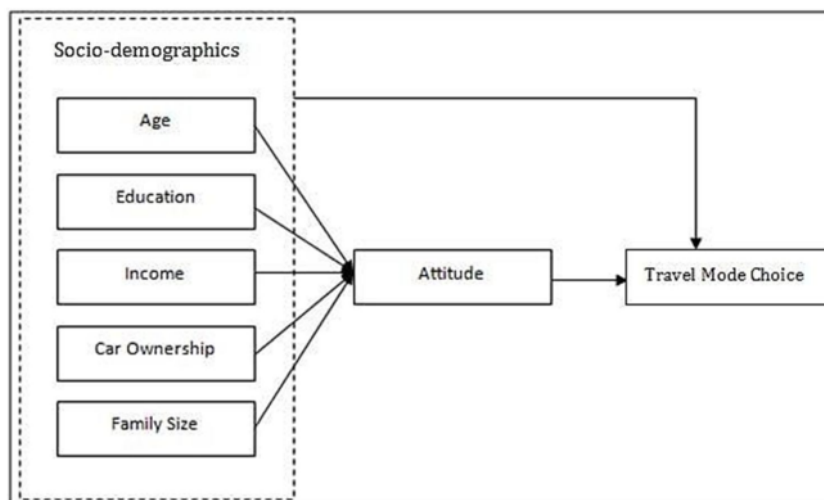


Figure 1. Conceptual Framework

2.1. Socio-demographic and attitude

Socio-demographic variables are the potential factors that are usually used to predict consumer attitudes and intentions. It is not surprising that their role as such was commonly examined and measured in numerous studies. Sun et al., (2011) study regarding the relationship between socio-demographic factors, stress, health status, coping strategies, and attitudes. The study found that factors associated with an increased likelihood of smoking are: stress on male students, and hold attitudes toward smoking approvals, acceptance of smoking exposure, and inadequate knowledge of the effects of smoking on the health of both boys and girls.

Nandamuri and Gowthami (2012) found that out of the five demographic factors tested, occupation and income emerged as the strongest determinants of attitude towards branded products, Followed by age and education, whereas gender did not yield a strong significance. Wu (2003) reported that the Fishbein model can effectively measure consumer attitudes and the examined consumer characteristics were important influence factors on consumer attitudes and online shopping decisions. Previously, Moon et al., (1999) also reported that the perceived attributes with respect to taste and price consistently influenced consumers' overall attitude toward peanuts and consumption behavior. The following hypotheses were proposed:

H1 : there is a significantly effect of socio-demographics on travel attitude

H1a : age is significantly effect on travel attitude.

H1b : education is significantly effect on travel attitude.

H1c : income is significantly effect on travel attitude

H1d : car ownership is significantly effect on travel attitude

H1e : family size is significantly effect on travel attitude

2.2. Attitude and travel mode choice

Research in social psychology has become the most popular reference in explaining the behavior of the selection of modes of transportation. Attitude theory, and its relationship to behavior, may help to understand the decision-making process underlying mode of choice. In this context, the attitude should be understood as a long-term evaluation of the social aspects of the world that are denominated attitude object (Garling et al. 1998). This evaluation has a direction (i.e positive or negative) and intensity (Baron and Byrne, 2005 in Domarchi et al., 2008). Attitudes are used as antecedents mode selection (Garling et al., 1998; Mann and Abraham, 2006; Domarchi et al., 2008; Frank et al., 2008).

Mann and Abraham (2006) in his research to clarify the role of affective responses in the choice of transport mode. Several factors were identified: such as personal space, autonomy and identity. Individual factors 'utility' such as time, cost and reliability has an important affective effects, and these are considered together as a utility component. Domarchi et al (2008) in his research proved that the habit of using the car positively correlated positive attitudes and emotions towards the car. Estimation of discrete choice models indicate that attitudinal variables are presented has a significant contribution to the selection of transport modes. The results showed that the choice may be affected by factors related to attitudes and assessment of

user affective modes of transportation. Frank et al (2008) using the approach attitude on travel time, costs, and patterns of land use on modal choice. His research concluded that the urban form at the location of housing and employment, and travel time and costs are significant predictors of travel options.

H2 : attitude is related with travel mode choice

2.3 Socio-demographics and travel mode choice

A framework for a comprehensive system of consumption is mainly applied to the purchase of vacation travel behavior developed by Woodside et al (2007) in Kattiyapornpong and Millier (2009). This framework shows how the demographic variables, socio-economic variables and the impact of family influence travel decisions and travel intentions. Travel preferences are generally less constrained by considerations of income and family and a place where people want to go. Actual travel behavior may be limited by macro-system variables such as age, income and life stage. This study found age, income and life stage will have less effect on travel preferences and a greater effect on travel choices (Kattiyapornpong and Miller, 2009). Yang et al (2010) used individual socio-demographics, travel-activity attributes, and land-use characteristics as exogenous variables. This study found that individual's destination choice behaviors with different socio-demographics and travel modes are examined as well. Previous studies conducted by Hiscock et al (2002) examined the impact of perceived psycho-social benefits of car use and ownership. The results found that there were some psycho-social benefits to car users.

H3 : there is a significantly effect of socio-demographics on travel mode choice

H3a : age is significantly effect on travel attitude.

H3b : education is significantly effect on travel mode choice

H3c : income is significantly effect on travel mode choice

H3d : car ownership is significantly effect on travel mode choice

H3d : family size is significantly effect on travel mode choice

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3. Methods

3.1 Data Collection

The data for this study was gathered by using questionnaires of two hundred and nine respondents which are representing three transportation modes user (private cars, motorcycles, and public transport) in daily activities.

The sample consists of 58.85% male, and 41.15% female. The majority age of the respondents (62.67%) is in the range of 19 to 39 years old. With respect to academic qualifications, a majority (50.24%) of the respondents had received a bachelor's degree while 9.57% of the respondents had obtained their postgraduate degrees. For occupation status, 69.38.0% were employed while 30.62% of respondents were students. Based on the social status that are grouped into two categories, namely income and motor vehicle ownership showed that the majority of respondents have an income ranging from 4 to 5.9 million rupiahs (40.67%), then an income above 10 million (22.49%), and income 1 - 3.9 million (19.14%). A total of 26 respondents do not have a motorcycle (12.44%), 79 people have motorcycles (37.80%), 25 people have cars (11.96%), 45 people have motorcycles and cars (21.53%), and 34 people have more than one car and motorcycles (16.27%).

3.2 Measurement

The socio-demographic characteristics data collected were age and education; and social status measures as monthly income in Indonesia rupiahs and number of vehicles. Attitudes measured by asking rate of interest about cost, accessibility, safety and comfortability of transportation mode selected. For example, "how important your considerations regarding transportation costs?". Answers for this question could be "not important" to "very important". Transportation modes are grouped into three modes, namely public transport, motorcycles and private cars.

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3.3 Data Analysis

To test the study hypotheses, Partial Least Squares Structural Equation Modeling (PLS-SEM) was utilized.

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Partial Least Squares (PLS) is a wide class of methods for modeling relations between sets of observed variables by means of latent variables.

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4. Result And Discussion

4.1. Measurement model (outer Model)

For construct validity, the loading and cross-loading of the items were investigated. Significant loading is 0.5 and above (Hair et al., 2010). Table 1 shows that all the items representing one construct are loaded highly on that construct while the other constructs are loaded much lower.

Thus, the content validity of the measurement, outer model was confirmed.

Table 1. Cross-Loading

Scale Items	ATTITUDE	MODE	AGE	EDUC	INCOME	COW	FAMSIZE
COST	0.899	0.769	0.160	0.171	0.318	0.487	0.012
ACCESS	0.667	0.336	0.004	0.032	0.091	0.156	0.028
SECURE	0.830	0.573	0.158	0.126	0.144	0.331	-0.043
COMFORT	0.832	0.604	0.167	0.095	0.124	0.266	-0.116
CHOICE	0.745	1.000	0.307	0.259	0.249	0.510	-0.003
AGE	0.168	0.306	1.000	0.632	-0.119	-0.075	-0.099
EDUC	0.146	0.258	0.627	1.000	0.030	-0.043	-0.044
INCOME	0.232	0.249	-0.116	0.029	1.000	0.662	0.319
NVEC	0.417	0.510	-0.070	-0.043	0.662	1.000	0.246
FSIZE	-0.040	-0.003	-0.098	-0.044	0.319	0.246	1.000

Composite reliability, average variance extracted as well as factor loading can be used to measure convergent validity (Hair et al. 2010). As shown in Table 2, the composite reliability 0.881 (> 0.70); Cronbach's alpha (CA) 0.812 (> 0.70) and the average variance extracted (AVE) was 0.652 (higher than 0.5). The measurement model indicates that attitude is valid based on parameter estimates and statistical significance.

Table 2. Convergent Validity

Construct	Composite Reliability	AVE	Cronbach Alpha
ATTITUDE	0.881	0.652	0.812

The discriminant validity is assumed if the diagonal elements are higher than other off-diagonal elements in their rows and columns. Correlations among the constructs are presented in Table 3. In Table 3,

5 for each variable, the root of the AVE value was larger than the correlation coefficient values with any other variable, thereby verifying the discriminant validity. As Overall 7 can be concluded that the evaluation of outer model has been fulfilled so the next evaluation is the evaluation of inner model.

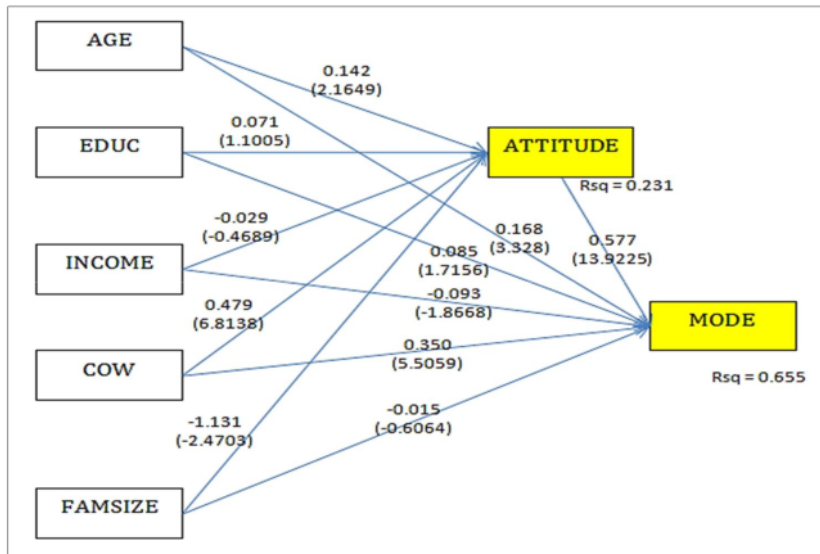
Table 3. Correlation of Latent Variables

	ATTITUDE	MODE	AGE	EDUC	INCOME	COW	FAMSIZE
ATTITUDE	1						
MODE	0.742	1					
AGE	0.167	0.304	1				
EDUC	0.145	0.257	0.627	1			
INCOME	0.230	0.248	-0.119	0.029	1		
COW	0.414	0.508	-0.075	-0.043	0.659	1	
FAMSIZE	-0.040	-0.003	-0.098	-0.044	0.318	0.245	1

4.2. Structural model (inner model) and Hypotheses testing

27 Having established the validity and the reliability of the measurement model, the 1 next step was to test the hypothesized relationship by running PLS algorithm and Bootstrapping algorithm in Visual PLS.

The hypotheses testing results are presented in Figure 2. The R^2 value for attitude is 0.231, which explains that 23.10 % of the variance of attitude can be explained by socio-demographics (age, education, income, car ownership and family size). Also the R^2 value for travel mode choice were 0.655 respectively which indicates 33 that travel mode choice have 65.50% can be explained by socio-demographics (age, education, income, car ownership and family size) and attitude. 8 Based on the assessment criterion suggested by Cohen (1988), 0.26 substantial, 0.13 moderate and 0.02 weak; the R^2 here is considered moderate indicating the power of socio-demographics in explaining the attitude; and substantial indicating the power of socio-demographics and attitude in explaining the travel mode choice.



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Figure 2. Structural Model

The hypotheses test results (Table 4) was supported of 6 from 11 hypotheses. Age is positively related (t value 2.1649.) to the attitude; car ownership (COW) positively related to attitude (t value 6.8138); family size negatively related to attitude (t value -2.4703). In travel mode choice, attitude, age and car ownership has also a significant relationship with travel mode choice (H1a, H1d, H1e, H2, H3a; and H3d supported).

Tabel 4. Hypotheses Testing

	Relationship	Coefficient	T value	26 Results
H1a	AGE->ATTITUDE	0.142	2.1649	Supported
H1b	EDUC->ATTITUDE	0.071	1.1005	Rejected
H1c	INCOME->ATTITUDE	-0.029	-0.4689	Rejected
H1d	COW->ATTITUDE	0.479	6.8138	Supported
H1e	FAMSIZE->ATTITUDE	-1.131	-2.4703	Supported
H2	ATTITUDE->MODE	0.577	13.9225	Supported
H3a	AGE->MODE	0.168	3.328	Supported
H3b	EDUC->MODE	0.085	1.7156	Rejected
H3c	INCOME->MODE	-0.093	-1.8668	Rejected
H3d	COW->MODE	0.35	5.5059	Supported
H3e	FAMSIZE->MODE	-0.015	-0.6064	Rejected

5. Implications And Limitations

This present study empirically examines the relationship between socio-demographic on attitude and travel mode choice but does not consider psychological constraints. From the analysis presented, it shows that age and car ownership are positively related to the attitude but family size negatively effect. Meanwhile, two other variables, namely education and income are not supported. In the travel mode choice, only age and car ownership is a significant effect, whereas education, income and family size is not proven.

The results of this study showed that the attitude is determined by age and car ownership. The higher of the age, the benefit to cost, accessibility, safety and comfortability higher. In addition, car ownership is also a cause of the high interest of the traveler on the cost, accessibility, safety and comfortability. Family size ³⁴ has a negative impact on the attitude of travel. This indicates that the larger the family size, mode of user behavior on the four aspects of the measurement (cost, accessibility, safety and comfortability) would be lower. Present study found that ²¹ there were some psycho-social benefits to car users. Car users felt that they gained from their security and accessibility of car and car-ownership makes the decision to use private cars is increasing. Thus, the government's efforts to reduce the use of private cars can be started with the development of mass transport that can provide a sense of security, accessibility, low cost, and convenience services.

Attitude has a strong influence on the selection mode. Attitudes on cost, accessibility, safety and comfortability of transportation modes are clearly a major consideration in the selection of modes of transportation. Attitudes on access by private car responded relatively higher than motorcyclists and public transport. Attitude of security, indicating the level of importance on the security aspects of higher relative correspondent by private car users compared with users of public transport and motorcycles. While the aspect of comfort, the car turns users tend to have an attitude and a higher interest in the aspects of comfort. It can be stated that the selection of a private car transport modes is dominant based on consideration of all aspects including cost, accessibility, safety and comfortability.

This study certainly has limitations that do not affect the study results. Limitations of this study can be used as reference material for future research examines more specific about mode choice, activity and satisfaction in the context of behavioral research trip journey. The first limitation, this study took samples only in the city of Manado, and thus it has a limitation in terms of generalizability to other cities that have characteristics and different population densities, such as Surabaya and Jakarta. Consideration of the quality ¹³

of public transportation, road characteristics, road density are all factors that can be the cause of differences in mode choice and trip activities were not observed in this study. Thus, further research is recommended in several cities to obtain a more comprehensive picture that can be generalized in general.

A second limitation is the variable used. This study only uses the approach of socio-demographic factors in influencing attitudes and selection of transportation modes. Physical factors such as urban form, population density, land use, access to services and transport infrastructure not scrutinized so further research is advised to include these factors in advanced research. A third limitation is the research model. This study uses a process approach to identify factors that influence user behavior, and then this attitude will affect travel mode choice, and the indirect effect of the socio-demographic characteristics of mode choice through this attitude is not specifically tested through structural analysis. Thus, further research could examine the effect of this indirect effect through indirect estimation of demographic characteristics to the selection mode via attitude.

6. Conclusions

This present study empirically examines the relationship between socio-demographics, attitude and travel mode choice. Numerous socio-demographic factors including age, household income, family size, car ownership, and education observed in this study. This study proved that the socio-demographic characteristics (age and car ownership) were positively and significantly related to attitudes and mode choice; attitudes were positively and significantly related to travel mode choice. In an effort to decrease the use of private vehicles (especially private cars), four aspects that need to be fixed is the cost, accessibility, safety and comfortability because it is a major concern of private car users based on research results. Government is advised to perform a larger survey to the private car users about their expectation and desires so that the aspects that are considered important can be used as a reference in planning mode of transportation. Consideration of urban form, the quality of public transportation, road characteristics, and population density that are factors suggested for future research.

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