“The perceived attractiveness of public transportation”

Master thesis

Urban, Port and Transport Economics

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Abstract

Rapid urbanization, population increase, modern lifestyle and economic conditions raise the necessity for mobility, and consequently for transportation in the most developed countries (Polat, 2012). Although public transportation is considered as one of the most significant instruments of mobility, still people prefer travelling by the car. A good public transport system can motivate people to shift from their own cars to public transportation, declining, via this way, energy consumption, traffic density, car ownership and environmental pollution. Yet, forming an accurate and of high quality public transportation is a complicated task, since it deals with attitudes and perceptions. Travel behavior is based significantly on individuals' preferences, attitudes and perceptions of different modes (Gardner et al., 2008).

This thesis, therefore, aims to investigate people's attitudes towards different aspects of public transportation focusing on its instrumental and symbolic-affective ones. A grounded theory approach in combination with factor analysis and binary logistic regression are applied. The results prove that positive attitudes towards the instrumental aspects of public transportation lead to an increase in the use of this mode while people seem to be indifferent towards the symbolic-affective aspects of public transportation and their travel behavior is not affected by these factors.

Both policy makers and operators need to comprehend how passengers assess the quality of service and adapt the service to the attributes to satisfy their needs and affect a modal shift (Anable, 2005). In addition, advertising campaigns should promote the environmental benefits of travelling by public transport by transforming it into an environmental symbol, and thus offsetting the car as a symbol of status (Golob et al., 1998). Last but not least, the car is promoted as a symbol of control, force, social status and self-esteem (Steg, 2005). One solution is "De-marketing" the car by highlighting the negative aspects of using it and decreasing the power of affective connotations created by advertisements.

This thesis concludes that a positive image of the mode is not enough since individuals may not choose that specific mode even if they have a positive attitude towards it (Loncar-Lucassi, 1998). Habits, cognitive dissonance, direction of causality and self-interest motives are some of the factors having a strong influential power on travel choice than attitudes.

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Chapter 1: Introduction

Mobility plays an important role in humans' lives, especially in big countries. In the last decades mobility has increased essentially in all European countries (Albalate et al., 2010). Public transportation also named as public transit and mass transit, represents all transport systems in which individuals do not utilize their own vehicles and incorporates modes of transportation such as bus, tram, metro and rail. Public transportation services are more than mere transport services as they are one of the most essential instruments of mobility for a significant proportion of the population in many cities. Due to rapid urbanization, population increase, modern lifestyle and economic conditions more and more people tend to use public transportation as their preferred mode of transportation. Modern life brings the necessity for mobility as well as for transportation leading to an increase in demand for public transportation (Polat, 2012).

In the contrary, in the most contemporary societies, cars are still used as a widespread transportation mode. The motivation behind this behavior seems to be the feeling of freedom, status, flexibility and comfort offered by cars (Steg, 2005). Furthermore, some evidence has proved that individuals may not always utilize their car because it is necessary, but because it is their choice (Handy et al., 2005). This broad use of private vehicles results in the deterioration of the local and global environment in many ways. Drastic climate change concerns the scientists and researchers due to its potential catastrophic consequences not only on the planet but also on people's lives. It has been observed that climate change is almost man-made, with the private cars to be a considerable source of air pollution (International Panel on Climate Change, 2007).

As a result, it is of high importance to decrease private vehicle use in cities, by encouraging people to travel by public transport. A good public transport system can motivate people to shift from their own cars to public transportation, declining, via this way, energy consumption, traffic density, car ownership and environmental pollution. Yet, forming an accurate and of high quality public transportation is a complicated task, since it deals with attitudes and perceptions. Travel behavior is based significantly on individuals' preferences, attitudes and perceptions of different modes (Gardner et al., 2008). The necessity and desire to comprehend, explain and forecast how people choose their mode of transportation dates back centuries and it is a common topic throughout society. However, human travel behavior does not succumb to a fixed pattern but is repeatedly changing (van Cranenburgh et al., 2012)

Being aware of the effect of attitudes is crucial for the policy makers. Investing money in ameliorating public transportation would not result to more public transportation use if traveling by public transportation is determined by attitudes and not access to it. Yet, if public transportation was based on access and not on people's attitudes, then investment would be an effective approach. So, to increase the use of alternative modes of transportation and decrease the extensive use of private vehicles, it is necessary to understand people's experience and opinions towards public transportation (Beirao et al., 2007).

By comprehending the behavioral beliefs, individual's attitudes towards the use or non-use of public transport can be simultaneously understood. People can be stimulated to travel more by public transport, if the underlying patterns of travel behavior are understood. Nowadays, the car is the most attractive mode of transport, since the majority of people believe that it comes with comfort, convenience and sense of freedom and speed. This implies that public transportation service needs to be adjusted so as to get the same attractiveness (a more attractive public transport system). Yet, it is difficult and complicated to detect a set of relevant attitudes. It is crucial to recognize the reasons of not using public transport to assess the perceptions about it. For instance, how those people feel if they had to travel by public transport and what would be the motivations to alter their travel behavior to a more sustainable one (Beirao et al., 2007)?

This thesis, therefore, aims to investigate people's attitudes towards public transportation. The research question is constructed as follows:

Do people use public transportation based more on instrumental factors such as convenience, speed and cost, or more on affective-symbolic factors such as status, freedom and excitement?

There are three main sub-questions need to be addressed to answer the main research question: Firstly, **which is the role of attitudes in the prediction of travel behavior?** Secondly, **which factors are characterized as instrumental and which as affective-symbolic and how these factors affect the use of public transportation?** Finally, **is the impact of instrumental factors on public transportation use higher than the impact of symbolic-affective factors, or vice-versa?**

Data collected by the second wave (2014) of the Netherlands Mobility Panel (MPN) is utilized in this thesis. MPN is a longitudinal research that links the travel behavior of individuals and households dynamically over time as well as how changes in travel behavior, personal and household attributes and other elements influence mobility. This panel includes a household survey, a personal survey and a three-day mobility diary with more than 6,000 participants in almost 2,000 households (around 4,000 participants have a complete personal survey, household survey and mobility diary). The data had been gathered in four consecutive years (2013-2016) (Hoogendoorn et al., 2015).

The dependent variable being central to this thesis is if an individual makes use of the public transportation or not. For this study, the main focus is on the urban public transportation (bus, tram and metro) and not on the train. Firstly, a factor analysis is conducted to group the independent variables into smaller factors and then a binary logistic regression model is developed to measure how much public transportation usage depends on people's attitudes towards the instrumental aspects of public transportation or its affective-symbolic ones controlling for socio-demographic characteristics, built environment and land use, and trip characteristics.

The thesis is structured as following. In the second chapter, the paper investigates and summarizes previous studies on how people choose their mean of transport as well as which factors determine the use of public transportation. Via the analysis conducting on this chapter, the first two sub-questions will be answered too. In chapter 3 and 4, the data and the methodology are introduced so as the main research question and the third sub-question to be answered, while in chapter 5 the results are analyzed. Finally, conclusions and further recommendations are drawn in chapter 6 and 7 respectively.

Chapter 2: Literature Review

Before attempting to answer the main sub-questions of this thesis, the first part of the literature review is a small introduction in the urban public transport system. More specifically, the main urban public transportation modes, the role of public transportation in sustainability as well as the measurement of public transportation performance are examined.

In the second part of this section, the differences between the utilitarian and behavioral theories are discussed to specify how commuters choose their mode of transportation. By investigating these two approaches the first sub-question is answered. Finally, the factors affecting the use of public transportation and the importance of those factors on people's travel behavior are analyzed (sub-question 2).

2.1 Urban public transport systems

In the last decades urban centers play a crucial role because of the dramatic growth of population being experienced. An increased flow of passengers and cargo is moving within the urban areas, making cities the "economic fuel" of countries and the source of all the economic activities (Rodrigue, 2013).Thus, it is very important to develop an effective transport system in order to accommodate the needs of the urban communities (Salifu,2004). According to Takyi et al (2013, p.226) "the system of transportation that offers access and mobility for individuals and goods is defined as urban transportation and incorporates elements such as public transit (collective transport); non-motorized transport (pedestrians, cyclists) and freight."

As stated by Gwilliam (2003), developing and transitional economies have difference in economic, political and demographic characteristics. Vehicle ownership is based on the income. He explains that relatively wealth and rich countries are more congested but more capable to afford the investments in mass transit. On the other hand, he further states that in countries with rapid demographic growth, the development of mass transit is less possible to have occurred. So, the dominant feature seems to be the city size, which influences the average trip lengths and density. Large, dense areas are characterized by high level of traffic congestion and its subsequent environmental pollution. The shape, size and functionality of the towns have been transformed due to investment in urban road capacity, fast growing car ownership, in combination with urbanization and population growth.

While some people use public transportation for their daily needs, most of them still own cars and depend on them for travel. The model of car-oriented cities of the previous century must be restrained and be replaced by a more sustainable one. Public transport is considered one of the most valuable strategies to address the problems created by car dependence, for instance urban congestion, air pollution and global warming (Currie et al., 2008).The social pressure for a more sustainable and qualitative way of life has forced the policy makers to pay attention on the advantages of public transportation, namely the decrease of fossil fuel usage, the form of a strong economy by transferring people to and from work, congestion avoidance, creation and maintenance of jobs and the offer of access for all ages (Stjerneborg et al.,2016).

According to Chatman et al. (2011), a faster and cheaper public transportation system alter not only where firms are established and how close they will choose to be to their suppliers but additionally where they will build their warehouses. Cities that have better accessibility may raise in size and density. Last but not least, a good transportation network may be beneficial regarding employment in cities and firm clusters by amelioration firm connection to labor and among companies. Employees are more willing to commute to their work, search for jobs when they are unemployed and ignore the distance so as to find the proper job, which results to increased productivity. Therefore, public transport can have a great influence on the society too.

2.1.1 Modes of urban public transport

The main modes of urban public transport consist of para-transit (including minibus-taxi), bus and bus rapid transit (BRT), light rail transit (LRT), suburban rail and rapid rail transit/Metro-rail (RRT) (Wright et al., 2005). Urban public transport modes and more specifically the mass rapid transit contribute to the transportation of a large amount of people at the same time decreasing traffic jam and generating efficiency. Mass transit serves the public at a lower operating cost, spending less fossil fuel and public space and being more environmental friendly compared to private vehicles (Berhan et al, 2013).

Investments in a more improved and advanced public transport system, such as heavy rail, light rail and particularly bus rapid transit have been fulfilled throughout the last years in Europe and USA, so as the public transport to be transformed into a more attractive alternative mode of transportation compared to the car in towns (Cervero, 2013). Although the governments have tried to promote the bus rapid transit systems, the “conventional bus” seems to dominate in the most developing countries. This can be explained by the fact that it offers flexibility satisfying all kind of distance mobility demands, it is economically feasible for all groups and mainly the poor people and it is compatible with the technology of the local facilities (Abreha, 2007).

Urban buses account for 60% of the total European public transport (ERTRAC, 2011). So, it is of high necessity for them to be cheap, reliable and to offer services with quality (Kumar et al., 2004). Solutions such as the addition of extra buses, amelioration of information systems and ticket integration could boost the usage of buses and generally of the public transportation (Hensher, 2007). Metro and tram is considered also the key access for passengers who live in the suburbs to reach destinations in city centers without being obliged to take their cars. Although they are costly to be constructed and maintained, they can offer long-term socio-economic and environmental gains. Many studies have analyzed the public benefits of the investment in public transport infrastructure and, by far, they exceed the investment costs (Pardo, 2010).

2.1.2 Sustainable urban public transportation

Transportation offers a lot of advantages on people's lives but also yields a variety of negative impacts. Fuel combustion for transport is responsible for 24% of Greenhouse Gas (GHG) emissions in Europe in 2016 contributing significantly to climate-change threat (Eurostat, 2016). Consequently, a special focus on social, economic and environmental matters should be introduced in a definition of sustainable transportation and its implementation to decision making (Bongardt et al., 2011). To be formed more sustainable cities, there is a high urgency of orienting the urban transport development towards a more viable future.

The role of the transportation sector to the creation of more sustainable cities must be more active. A shift towards more sustainable modes of transportation for instance public transport and the incorporation of non-motorized transport (walking, cycling) is considered crucial. Nowadays, an integrated transport system with a focus on access/egress modes can be proved beneficial for the consolidation of public transportation as the preferred travel modal. Figure 2-1 highlights this integrated transport system by depicting the entire transport chain. The transport chain is the whole trip from origin (O) via access node (AN) and egress node (EN), utilizing in this case the bus link, to the destination (D) (Brand.et al, 2017).

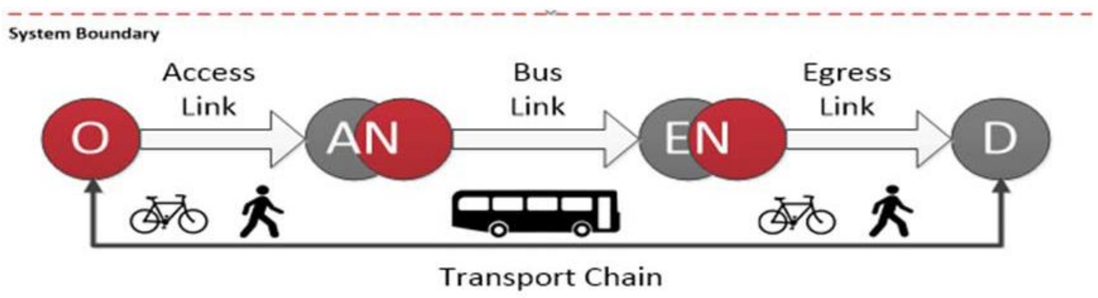

Figure 2-1: The integrated transport system (Brand et al, 2017)

Access and egress are one of the most important elements in the transportation chain, defining the availability and the convenience of public transportation. By improving the access and egress stages, it is potential to decline significantly the duration of trips by public transport. This method is considered less expensive than to invest on infrastructure and vehicle improvements (Krygsman et al., 2004). Access and egress are mainly a walking and cycling activity, being sensitive to the weather conditions (for instance rain, wind or snow), land-use characteristics and distance. Environmental conditions cannot be controlled by policy makers, but land-use factors and distance are two very crucial elements in the design of the public transport system. Many studies have proved that the distance to (from) transit locations is very important regarding the choice of access (egress) mode choice. An increase in this distance substantially diminishes the intention to use public transport (Krygsman et al., 2004). Yet, this situation is of less significance when commuters can use "continuous" entry or exit travel mode (for example cycling or walking) to the public transport stop (Rietveld, 2000).

Bicycle is considered to be more effective as a transport mode on the access side, while walking on the egress side. This can be explained by the fact that individuals have a greater variety of modes on the access side of the journey. However, on the egress side these modes are less or no available. Consequently, the combination of cycling/walking and public transport stops can be valuable if more parking facilities are provided on the access side and more opportunities on the egress side in the form of bike-sharing and bike -renting ones (Brand et al, 2017).

Bicycle sharing has the possibility to surpass all the obstacles related to public transportation and bicycle (Jäppinen et al., 2013). By integrating bicycle sharing systems into public transportation can promote the use of bicycle to and from transit stops. Yet, most of the travelers own a bike in the access phase. As a consequence, a bicycle sharing system would support public transportation by offering transportation in the egress stage and by raising its competitiveness regarding the private car. The existence of bike sharing systems close to public transportation stations or stops would enforce multimodal transportation since they would provide more continuous connections or accessibility to suburbs and work locations (Zhao et al., 2017).

Like in other European countries, individuals in the Netherlands are using more and more the car to cover their daily mobility needs. The road network is gradually reaching the limits of its capacity, especially during the morning, making public transportation and the bicycle parts of the solution. In a daily base 4,5 million trips are due to bus, tram and metro, 1 million are made by train and more than 14,5 million by bicycle (Management Ministry of Transport Public Works and Water, 2010). The fact that the number of bicycles used is significantly high, on the one hand, can play an important role in the promotion of a more sustainable way of living but, on the other hand, can undermine the utilization of public transportation as the main travel mode.

Policymakers and decision makers must take into consideration that the establishment of a sustainable urban transport system demands an extensive and accurate approach, focused on the promotion of affordable, economically feasible, human-centered and environmentally friendly transport systems (Pardo, 2010).According to Banister (2008), a proper transportation system with a focus on sustainability is made up of four main aspects being mainly: 1) actions with a main focus on decreasing the need to travel, for example the incorporation of technology in people's daily activities (Internet shopping, teleworking) 2) transport policy measures that support the shift towards a more sustainable mode of transportation. This can be achieved by reallocating space to public transportation and making a more efficient utilization of free space 3) trips with short duration by public transport-oriented improvements and land-use planning actions 4) increase of efficiency through investment in alternative fuels and renewable resources for more "green" modes of transportation.

Public transit can be proved a strong competitor to the private automobile travel, as it offers a more energy efficient transportation (Schiller et al., 2010). This makes public transportation an important factor for decreasing dependence on cars, which in turn can lessen the negative effects of private vehicles. Considering the relation between car mileage and air pollution, this transforms public transit in a key player of sustainable mobility (Miller et al, 2016). Yet, this modal shift must be combined with an allotment of the public space that was once utilized for auto- travel purposes and the increasing of the amount of metro, buses and trams during the peak hours, improving access to the public transportation (Banister, 2008).

2.1.3 Public transport performance

A variety of performance measures have been developed for outlining different features of the transit services. Passengers, agency and community have a different point of view regarding transit performance measures. Commuters evaluate public transport performance based on service quality indicators while transit agency assesses as a business. Finally, community's point of view is based on the effect of transit service on different aspects, for instance employment, property prices, economic development, mobility and environment. (Transportation Research Board, 2003).

According to Schlossberg et al. (2013) performance evaluation can be divided into three categories: 1) productivity measures, with a focus on efficiency indicators and effectiveness. Efficiency is measured by making a comparison between the volume of service offered (vehicle revenue/hour) and the utilization of the resources by the operator (labor, fuel or capital). Effectiveness is measured by the volume of the transportation service consumed by the commuters 2) quality measures, with a focus on travelers' perspectives regarding public transit performance, for instance frequency, comfort, speed and safety and 3) impact/availability measures, with a focus on the impacts of the public transport system on the community, namely accessibility to(from) jobs.

As it is observed, there is a wide range of indicators, from those that reflect the economic side of producing the service (investment and operation) to the service quality provided (safety, reliability, convenience and travel time) and effects on the community (environment, urban growth). The quality of service produced has the largest number of indicators in order to be secured that the public transport operators offers a service being able to satisfy commuters' expectations. This is also because the impact of service level effects the preferences towards public transportation and thus its social dimension (Transportation Research Board, 2003).

2.2 Modal choice theories

How people tend to choose their travel mode? Is this choice the outcome of a more rational approach or attitudes towards the available transport means play the most important role? In this section of the literature a review of both utilitarian and behavioral theories are discussed so as to gain a better insight of how individuals act and select their means of transportation. Firstly, the utilitarian theory is examined and more specifically the Utility Theory and the Hybrid Choice Model. Then, it is discussed the modal choice from a behavioral perspective analyzing the Theory of Planned Behavior.

2.2.1 Modal choice from an utilitarian perspective

Micro-economic approaches assume that consumer's choice and behavior follow from costs and benefits, and that all aspects of the choice can be expressed in those terms (for example uncertainty about arrival times is also a cost). It is believed that individuals behave and elect between a set of alternatives based on rationality. As a result, people struggle to maximize their utility according to rational principles (Zafirovski, 1999).

Utility theory

Since the late 1960s, travel behavior studies have been mainly based on micro-economic utility-maximization theory, before the introduction of social psychology. According to this theory, travel alternatives are considered as a group of attribute features; the utility a person acquires from its attribute levels shapes the total utility of an alternative. Individuals always choose the alternative that provides to them the highest utility or satisfaction (Bohte et al, 2009). Ben-Akiva et al (1985) state that the satisfaction being obtained from the attributes of an alternative is evaluated indirectly by the actual behavior ("revealed preferences"), the features of the alternatives (such as, speed, cost, convenience), personal elements (such as, age, gender and income) and the decision framework, for instance land-use features. Part of the unexplained variance and, consequently, of the random error term is the affective evaluations (description of the experience of feeling or emotion) which are not incorporated directly in the models (Ben-Akiva et al, 1985). Morikawa et al. (1998) characterize the utility theory as an optimizing “black box” since it ignores the cognitive evaluations and people’s perceptions about the attributes.

If the preferences towards related attributes are known, discrete choice models are suitable for modelling behavior. The basic idea lain behind discrete choice approach is that people or decision makers elect from a variety of choices this alternative with the highest utility. In the model are included parameterized utility functions regarding measurable independent variables and unknown parameters. The characteristics of the alternatives are represented by variables which, in terms of transport planning, are often variables outlining the trip, such as travel durations and costs. Moreover, it may be included sociodemographic variables namely income, gender and age (Ben-Akiva et al., 1985).

Individuals select their mode of transportation based on how important they comprehend the gain for travelling to be- how they assess the travel modes. Most travelers will choose this travel mode with the smallest sacrifice but with the highest personal benefit. Travelling time, fare, level of comfort and reliability can affect what people perceive as benefit from a journey. Commuters have several alternatives from which they make rational choices regarding their mode of transportation. They can value their individual gains extracted from the differences among the characteristics of the alternatives. The significance of the different characteristics of the alternatives can be measured statistically. Naturally, these benefits are perceived differently by everyone. Therefore, people will not elect the same products or travel modes (Ben-Akiva et al., 1985). However, in a quantitative analysis, it is harder to include factors such as attitudes than factors such as travelling time or fares, so they often are ignored. Also, it is difficult for the researchers to quantify attitudes (Loncar-Lucassi, 1998).

Ohnmacht (2012) observed that there are some limitations concerning the utility theory. First of all, the theory supports that people, in order to maximize their personal utility, behave rationally and own perfect information (homo-economicus). However, it is widely accepted that decision makers do not have or desire full information to decide. Moreover, as a term, personal utility maximization is unclear since for every individual utility varies. In the most economic models, the maximization is usually linked with costs although some people are more concerned about, for instance, the minimization of their trip duration. Last but not least, the utility theory analysis tends to be too general as it is not possible to capture all relevant attributes for people's choice and to include individual beliefs and tastes regarding these attributes in the model.

Hybrid choice model (HCM)

Consumers' preferences, according to consumer choice behavior, are affected by the level of people's satisfaction regarding the available modes of transportation and the degree of their significance to the consumers. Because of the difference in socioeconomic status and in endogenous characteristics of travel modes, which can be indirectly measured or observed, individuals' perceptions to transport modes vary. That means that the evaluation of mode choice behavior is based not only on measurable elements (travelling time, gender, age or income) but also on unmeasurable ones (reliability, safety or image) (Chen et al., 2017).

In transport analysis, attitudinal variables incorporate perceptions about service reliability and environment, and possible preferences for the different travel modes, which result in the evolution of transport mode behavior models. Traditional models for transport mode choice have been extended by including attitudinal variables for simulating transport mode choice behavior (Chen et al., 2017). Morikawa et al. (1996) include variables, such as comfort and convenience provided by a mode of transportation, which are computed and simulated through attitudes (attitudinal indicator variables) towards the preferred travel mode and its alternatives. Finally, Ben-Akiva et al. (2002) forecast the demand of different transportation modes by integrating traveler's perceptions into their models.

During the last decades, a hybrid choice model (HCM) has been established to include the influence of attitudinal variables on the decision-making procedure (McFadden, 1986). By utilizing psychometric data, this model capture individuals' attitudes and perceptions and their impact on travel mode choice (Yanez et al., 2010). These variables can explain more efficiently how people behave concerning transport mode choice to accomplish a more accurate interpretation of the individual parameters influencing this choice.

2.2.2 Modal choice from a behavioral perspective

Individuals should make many choices about each trip they fulfil every day, and one of the most important is the mode of transportation. Researchers have investigated from many perspectives the actual choice behavior or decision-making process (for example Ben- Akiva et al., 1999). Social psychology, which is one of the main areas of study, explains that the procedure of choice initiates based on the information being available to the consumers. Then, people form beliefs about the numerous of options between they will make a choice. Beliefs can be faced as part of individuals' cognitive mental responses (Peter et al., 2005). Affect, attitudes, motives and preferences can influence significantly beliefs and perceptions (Ben- Akiva et al., 1999).

Affect is described as a situation where consumers may express their feelings regarding an object as "like" or "dislike" (Peter et al., 2005). This response is natural. For instance, when someone is always delayed going to his work due to traffic jams, he can dislike utilizing the car. According to Ajzen et al., (2005), when individuals expect that the positive consequences of performing a behavior exceed the negative ones, it is more likely to execute this behavior and vice versa. Attitudes can be defined as stable psychological impulses to assess certain outcomes with favor or disfavor (Ben- Akiva et al., 1999). On the other hand, motives are stimuli to succeed particular goals, such as the wish to be "environmental friendly". Finally, people's judgments about different entities and their results can be stated as preferences. A representative example of this concept is when individuals prefer a transportation mode over another.

In the previous example of an individual who dislikes going to his work by car because of delays by congestion, this dislike can contribute to the change of transportation mode, such as the utilization of public transportation instead of private vehicle. Researchers declare that, after conducting a thorough research on the relationship between attitude and behavior, intention has been included in between these two terms to comprehend better the cognitive process. If people's intention is not to behave in a certain way (for example to travel by public transportation), then it is extremely possible that they will not do so (Eagly et al, 1993).

Mode choice explanations can relate with behavioral approaches as the latter look for motivations for a specific behavior. Therefore, in the next part of this thesis the Theory of Planned Behavior is going to be discussed.

The Theory of Planned Behavior

The most famous social psychological theory that investigates the influence of attitudes on travel behavior is Ajzen's (1991) Theory of Planned Behavior. The Theory of Planned Behavior is based on expectancy–value theory which states that people's willingness to spend a certain amount of effort on a task is the product of (a) the level to which they anticipate succeeding at this task and (b) the level to which they value the task and the success on the task (Green 2002). The behavior which yields the highest expectancy–value product will be chosen (Eagly et al., 1993). According to the Theory of Planned Behavior, people perform behavioral decisions after examining carefully the available information (Ajzen, 1985). This behavior is the outcome of the intention to expose a certain behavior: individuals intend to be involved into a particular behavior (Ajzen, 1991). The intension to behave in a specific manner (motivation) affects behavior. Also, the individual's perception of his capability to perform a specific behavior influences his/her choice (Ajzen, 1985).

Intentions are based on three elements*:* attitudes, subjective norms and perceived behavioral control (Figure 2-2). A certain action is assessed positively or negatively by people and this evaluation reflects attitudes towards a behavior. Attitudes are based on beliefs that a behavior will bring particular results (for instance, commuting by public transportation is inexpensive, provides safety or ameliorates one's image) and on how significant these results are for a person. Additionally, social norms indicate the extent to which a person thinks the significant others and the intention to conform to their expectations. Finally, the level to which one believes that can be engaged in this specific behavior depicts the term of Perceived Behavior Control (for instance, how difficult someone believes is to travel by tram). Behavior is not influenced directly by attitudes, subjective norms and perceived behavior but by intentions and the degree to which an individual possess the adequate skills, resources and other requirements (Ajzen, 1991).

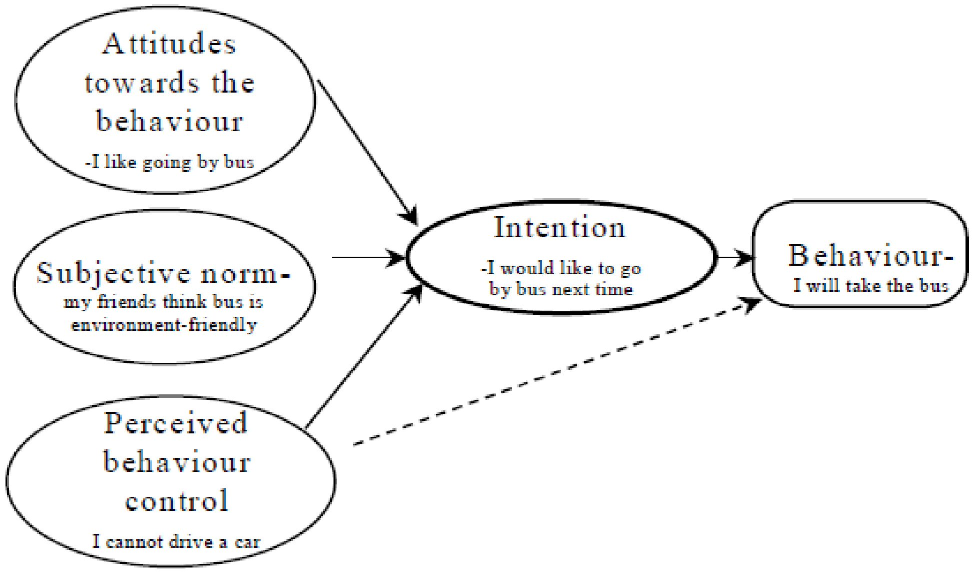

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Figure 2-2: The theory of Planned Behavior (Dzikan et al., 2003)

The Theory of Planned Behavior states that factors, such as demographics, influence behavior indirectly, via attitudes, subjective norms and perceived behavior control. For example, it is possible that men may use car as their mean of transport because they like driving (positive attitude), low-income groups might use public transportation more often because they have a higher perceived control (they can travel by public transportation) and individuals with deep environmental values may travel by public transportation because they are concerned about the positive environmental effects of using public transportation, leading in more positive attitudes towards its utilization. Yet, to which extent attitudes, subjective norms and perceived behavior affect intentions and behavior depends on the type of behavior. For instance, subjective norms will have less influential power when one's behavior is private and not visible to the others (one's family cannot observe which travel mode he used during his holidays in Greece). In this cases, attitudes and perceived control may have a stronger influence on behavior than subjective norms (Ajzen, 1991).

According to Haustein et al. (2007), the Theory of Planned Behavior is essential for analyzing travel behavior. It includes the main predictors to via mobility behavior is explained and, being composed of five parameters only (attitude, personal characteristics, social norm, intention and perceived behavioral control) it can be used in the context of survey researches. Finally, the Theory of Planned Behavior is flexible as far as the addition of predictors is concerned. Via this way, its predictive power can be increased.

Despite its undoubted approval, there is also critique on the Theory of Planned Behavior. According to Bagozzi (1992), subjective experience of desire is the missing link between attitude and intention in the Theory of Planned Behavior. He states that desire is mandatory to execute a behavior, since attitude alone is not enough. Bagozzi (1992) claims that there are two different types of desire: appetitive and volitive. Appetitive describes the need for some kind of consumption (for instance, to eat pasta) and volitive is more related with the desire to do something and is more similar to an attitude towards something (for example, make a visit to a friend). Attitude is converted into intention, if either the appetitive or volitive desire is triggered, or both (Bagozzi, 1992). Verplanken et al., (1997, p.558) argue that the "Theory of Planned Behavior omits the significance of daily, repeated and habitual behavior". The study of habits is very crucial in the field of social psychology since people is proved to form habitual behavioral patterns (always travel by car from the home to work) (Verplanken et al., 1997).

2.3 Factors influencing public transportation use

Based on which factors people prefer using public transportation as their basic mean of transport? So far it has been examined, from a theoretical perspective, how people are expected to choose their mode of transportation. However, this section reviews empirical findings on how people choose to use or not Public Transportation based on important factors namely instrumental and affective-symbolic ones. Those findings also prove the existence of heterogeneity in travel behavior since each person has different perceptions and criteria when it comes to modal choice.

2.3.1 Instrumental factors

The first category of factors that may influence the use of public transportation is people's attitudes regarding the instrumental aspects of public transportation. These variables have a high similarity with the objective attributes characterizing the alternatives. They can be evaluated with indicators such as "How do you grade the comfort during your journey by bus?" or "According to your opinion, how flexible is the bus schedule?" The most important instrumental factors being discussed in the next part of this thesis are comfort, safety and security, reliability, flexibility, convenience and accessibility and price (Daziano et al, 2015; Raveau et al., 2010).

Figure 2-4 represents the "Pyramid of Maslow" for public transportation. The pyramid shows different layers depicting the basic prerequisites public transportation system should have (such as comfort, reliability or ease). Public transportation users define these requirements and the significance that they attach to these requirements based on their motive to travel. The lower layer of the pyramid shows those travelers who demand safe and reliable public transportation service. If people's attitudes regarding safety and reliability of public transportation are negative, there is a high possibility to choose another mode of transportation namely cars. On the other hand, those who travel mainly for pleasure pay more attention on the price and comfort of the journey (Van Hagen et al., 2002). According to König et al. (2002), transportation system's reliability seems to be the most crucial factor influencing people's travel behavior.

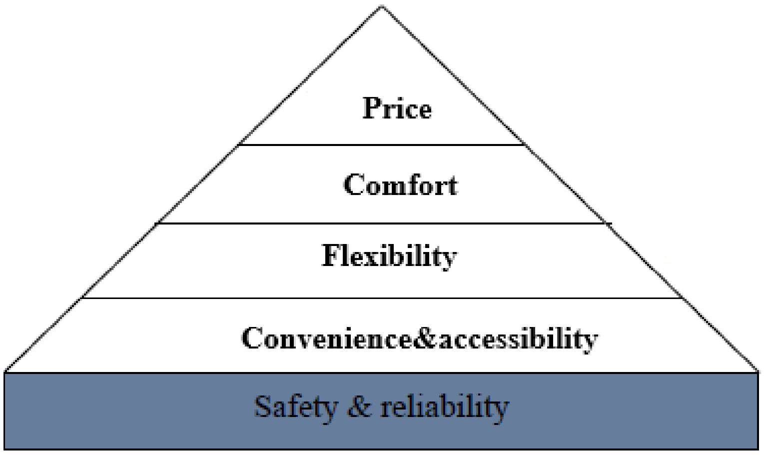

Figure 2-3: "Pyramid of Maslow" for public transportation (Van Hagen et al., 2002)

Each of these instrumental factors affecting the utilization of public transportation are analyzed below from this factor with the highest importance for the travelers to the factor with the lowest one (according to the "Pyramid of Maslow" presenting above).

Safety and security

According to Paulssen et al. (2014), public transportation is perceived to be safer and more secure than cars. Cars are believed to be less secure since they can be easily stolen and less safety since they are related with many accidents, often with tremendous or fatal consequences. On the other hand, public transportation is more reliable as far as safety and secure is concerned and these are two important reasons of being chosen by many commuters as their preferred mode of transportation.

Reliability

Reliability is a significant indicator for public transport and it gains gradual importance over the last years. However, in most countries, individuals do not perceive public transportation services as reliable (Levinson, 2005).

Raveau et al. (2010) describe reliability as the capability of estimating travel and waiting time before the journey, and as the level of availability of the appropriate information. Travelers should be able to rely on public transportation services on a regular basis. When buses or trams arrive later than it has been scheduled due to traffic congestion or system problems, this can decrease the reliability of public transportation. Raveau et al. (2010) conclude that commuters will choose this mode that offers to them the highest value in terms of reliability.

Convenience and accessibility

Indicators that are helpful to measure convenience and accessibility are the ease of access, regularity of public transportation, the existence of queues, waiting time and if the mode reaches the preferred destination. For example, if the distance or time that one should spend to arrive to the bus or tram stop is considered too long, then it is possible to choose to travel by car or other mode of transportation. In other words, a raise in distance (or access time) is believed to influence the use of public transportation negatively. If distance (or access time) surpasses a certain threshold (which is different among people), travelers may choose an alternative mode of transportation than public transportation (Cervero, 2001). Consequently, it is crucial to decrease the access time and raise the convenience for commuters to reach to their destination. Generally, if travel mode is perceived as convenient and easily accessible, it is more possible to be chosen against its alternatives. (Anwar et al., 2014)

Flexibility

Flexibility means the ability of a transport mode to be always available, to defy the weather conditions and when people feel that they can use it spontaneously and without planning. Metro tends to be more flexible compared to other modes of public transportation. (Johansson et al., 2006; Politis et al., 2012).

Comfort

The main concept behind the comfort variable is to identify the extent to which activities such as relaxation and work are provided by public transportation. Sometimes comfort can be assessed by the level of difficulty of using public transportation when, for instance, people are travelling with heavy luggage or with their children (Atasoy et al. 2013). On the other hand, people who have high comfort needs tend to choose public transportation as their main travel mode because they feel tired whilst driving, they cannot find parking lot or they can execute various activities while traveling by public transport such as reading or sleeping (Temme et al. 2007). Consequently, heterogeneity regarding the influence of comfort on travel mode decision seems to be significant since it ranges considerably among commuters (Yanez et al., 2010). Yet, all the researches on comfort, either as a necessity or a perception, lead in a common outcome: comfort is a crucial element in understanding how humans choose their mode of transport.

A positive perception of comfort on public transportation raise its utility and diminish individuals' sensitivity concerning travel time (Glerum et al., 2014). According to Daziano et al., (2015), trains are believed to be more comfortable than buses as in trains there is the possibility of working or resting since there is more space and the seats are more comfortable.

Price

Commuters' perception about the price of an existing fare is usually referred to their expectation about a logical price compared to the service they think it is actually supplied. In other words, if people believe, for instance, that the price is too high compared to the quality of service offered by public transportation, it is possible to choose another mode of transportation for their daily commuting. The solution is not to diminish the existing fares but to increase customer satisfaction by ameliorating quality attributes to reach individuals' perceived worth of the existing fare (Hensher et al. 2003)

Based on the information displayed above, it could be expected that people will choose public transportation as their preferred mode of travelling if their opinion about the different instrumental aspects of public transportation is positive. Thus, the first hypothesis is that positive perceptions regarding the instrumental aspects of public transportation increase the use of public transportation.

Hypothesis 1: Positive perceptions towards the instrumental aspects of public transportation lead to an increase in the use of this mode.

2.3.2 Symbolic-affective factors

What can make public transportation less attractive than car? The last decades, most of the studies have focused on the instrumental aspects of public transportation and transport policies have attempted to promote the utilization of public transportation by, for instance, raising the price of parking fee and gas or prohibiting cars from accessing specific areas. In most cases, such attempts have failed to accomplish their goal, suggesting that other factors may affect the use of public transportation (Steg et al, 2001). Recently, many researchers have tried to explain the influence of the symbolic-affective aspects of public transportation on individuals' behavior regarding commuting and how these factors correlate with car use (Steg, 2005).

It is believed that symbolic-affective factors, for example **status, image, arousal, autonomy and privacy** are usually linked with car utilization and less with public transportation since the latter is perceived as a symbol of inferiority (lower social status) and lower income (Şimşekoğlu et al., 2015). For instance, some individuals will not travel by bus because they believe that the others will assume that they cannot afford a car (image) or they will not use public transportation because they feel less powerful (prestige). This implies that car is more than a simple means of transportation and it is not famous only about its instrumental attributes (speed, flexibility and convenience) but also for its symbolic-affective ones. Steg (2005) proved that many commuters were using their car mainly because of its symbolic-affective attributes and less for its instrumental ones. Consequently, it is observed that for highly utilitarian trips, for instance commuting, affective and symbolic factors play a crucial role.

Various studies have examined the effect of symbolic-affective factors on the relation between the public transportation utilization as transportation mode and the willingness to decrease car use. Stradling et al. (1999) examined how willingness to reduce car use and two symbolic-affective factors (the feeling of independency and personal identity whilst driving a car) are related. They found that people who evaluate more strongly these symbolic-affective factors are less willing to use public transportation and simultaneously to lessen their car use. They also stated that 17% of the respondents will use more their cars in the short term. 29% of those who stated that they will use their cars more in the future gave enjoyment of driving as a reason behind this behavior (Stradling et al., 2000). Furthermore, Nilsson et al. (2000) observed that commuters being emotionally attached to their cars will drive more frequently than those who are less emotionally attached. Policy measures whose main goal is to reduce the utilization of cars will be less effective for the same group of individuals.

Sandqvist et al. (2001) proved that many people purchase and drive cars simply because they love to, and not because they really need to use them, or they find a practical reason behind. These people possess a car because they think car driving ameliorates their quality of life. Additionally, Jensen (1999) concluded in one of his studies that only a small portion of the respondents had strong positive feelings towards public transportation while most of them evaluated positively car utilization on many psychological and psychographic aspects. Last but not least, Steg (2003) reported that Dutch participants evaluate car use more positively on a variety of instrumental and symbolic-affective aspects while their attitudes regarding public transportation are less favorable. Even commuters who use car less often evaluated less positively public transportation in almost every respect.

These studies imply that symbolic-affective factors are not strongly correlated with the use of public transportation while the car seems to be more than a simple transportation mode. Even if policy makers endeavor to make public transportation more attractive in terms of service quality or price, symbolic-affective factors cannot be underestimated since they are strongly connected with car utilization and less with public transportation. This fact can explain partially why people choose the car as their preferred mode of transportation although public transportation may be, for instance, more flexible or safe. Via driving a car, it is possible that individuals discover a way to express themselves, their social position and their feelings (and they expect these feelings when it comes to choose their mode of transportation).

The second hypothesis depends on the fact that if people evaluate positively the symbolic-affective aspects of public transportation then it is possible the utilization of this mode of transportation to be increased.

Hypothesis 2: Positive perceptions towards the instrumental aspects of public transportation lead to an increase in the use of this mode.

2.3.3 Socio-demographic factors

In this section, it is discussed some of the main socio-demographic factors that can influence people's intentions to travel by public transportation. The most important socio-demographic factors are: age, gender, income and education.

Age

Age is an important factor because people aged under 18 years old are not allowed to possess driving licenses and are obliged to use mainly the public transportation. Leisure activities (visiting a friend or going for shopping) have been characterized by raising utility as age raises (Hensher et al., 2000). They suggest that older people like more leisure activities than younger ones. Steg (2005) conducted research in which most commuters using public transportation are older than 50 years old. Then comes people aged under 30 and the group using less often public transportation are between 30 and 50 years old. Individuals with an average age found the use of car more necessary than older ones.

Gender

Gender is a crucial factor as it can be linked with the status of occupying a car. According to Steg (2005), men are more vulnerable using the car as it is possibly related with some sort of social status. Men stated that car is crucial for their self-expression, and that is the reason why 73% of the sample driving car were male (Steg, 2005). There are three fundamental reasons why women tend to utilize more sustainable travel alternatives than men (Matthies et al., 2002): limited access to cars, a more environmentally friendly behavior and stronger public transportation habits. Since women use public transportation more often than men, policy planners and decision makers can set a target on this group (Hamilton et al., 2000).

Income

It is undoubtedly that people obtaining a higher salary can afford easier the use of a car than low-income people. However, Beirao et al., (2007) proved that although low-income individuals cannot afford a car, yet they consider the use of it as a huge achievement and they are not willing to commute by public transportation. This case can be supported by the study of Kenyon et al. (2002, p.217) who state that "an individual can be excluded without being poor and can be poor without being excluded". Therefore, "poor" people believe that they will be marginalized if they do not own or travel by car. They give higher value on possessing a car than an average income individual.

In general, it is plausible to assume that if the income changes, then travel behavior will be influenced too. High-income is related with raised mobility and therefore the number of trips fulfilled by all travel modes would increase because of this change. However, it is possible that individuals with high income own a private vehicle and thus they make less trips with public transportation (Holmgren, 2013).

Education

Education is also a significant variable that may influence the choice of mode of transportation. It is expected that higher educated individuals will gain a higher salary or have higher possibilities to get a job so a higher necessity of mobility. Consequently, commuters with a higher level of education is assumed to possess one or more cars and to use less public transportation. However, Burbidge et al., (2006) proved that people with a higher education may use public transportation more often than car because they are aware of the benefits of public transportation, for instance, on the environment or on their health. So, we can assume that regarding the effect of education on travel mode choice, it depends on the perspective being studied this relation.

2.3.4 Built environment and land use

Physical-geographical elements of the natural environment can make the movement in space either simple or complex, which can influence the travel mode choice. It is proved that individuals pay attention on the distance should covering between their residences and the nearest public transport stop (Brands et al. 2014). The preferred walking distance is 400m, after which point it is believed that the probability of commuting by public transport is dropped rapidly (Buehler 2011; Kimpel et al. 2007). Yet, individuals in Europe tend to feel more comfortable with negligibly longer distances, and thus the walking distance varies between 500m and 800 m (Walker, 2012).

The choice of travel mode is also affected by the density and diversity of each area. People often use public transportation in highly urbanized regions of the city center because of traffic jam and parking lots insufficiency (Haybatollahi et al. 2015). On the other hand, as the distance from the city center increases and population density and urbanization diminish, the utilization of cars as travel mode raises dramatically. (Brownson et al. 2009).

Last but not least, an interesting topic developed the last years is the effect of built environment and land use on the “residential self-selection”. According to Chatman (2014), people may decide where to live based on their preferences or needs to perform activities outside the home. Individuals preferring commuting via public transportation are more likely to buy or rent a house close to a public transportation stop; those preferring carrying out different leisure activities by car are more likely to search for a house near parking spots or the highway; people who enjoy walking may search for a house in neighborhoods with nice parks within walking distance.

2.3.5 Trip characteristics

Trip characteristics, such as trip purpose (work, leisure, school, shopping or others), trip distance and origin and destination information have been proved to affect the mode of travel. For instance, people may choose to travel to work by car because they consider car as a faster mean of transportation than public transportation but use public transportation for leisure purposes since they want to avoid congestion. Moreover, trip distance can influence modal choice. Shorter trips may be fulfilled by public transportation but for longer trips car seems more suitable. Last but not least, commuters demand the provision of information when they travel by public transportation. Timetables and service information help users to plan and coordinate their journeys both in origin and destination (Durand et al., 2015).

Chapter 3: Data

As discussed in chapter 2, there are two main theories that can explain commuters' behavior regarding the choice of the preferred mode of transportation: utilitarian and behavioral theories. On the one hand, utilitarian theories assume that consumers act and choose between a set of alternatives based on rationality. Always people choose, from a set of alternatives, the one that provides to them the highest utility or satisfaction. On the other hand, behavioral theories support that people choose their preferred mode of transportation based on the available information. Then they form attitudes which means that they assess certain results with favor or disfavor. Yet, the intention to behave in a specific manner affects behavior and should be taken into consideration.

The aim of this thesis is to examine people's attitudes towards public transportation since this approach can explain more efficiently the heterogeneity in travel behavior and subsequently how people choose their mode of transportation than the conventional utilitarian theories. More specifically, it is evaluated people's attitudes towards certain attributes of public transportation which are categorized into two main groups: the Instrumental factors and the Symbolic-Affective ones. In Chapter 2, it was already discussed which factors are considered as instrumental and which as symbolic-affective and how these factors affect the use of public transportation. This analysis plays an important role for the construction of Chapter 3, as it is defined which variables should be taken into consideration so as the main research question to be answered.

This chapter discusses the data of the present thesis and is formed as follows. In the first part, it is discussed why the Netherlands, as a study area, is suitable to conduct an investigation of people's attitudes towards public transportation as well as it is presented a brief description of the history of the Dutch public transportation system and the sustainable future of the Netherlands. Additionally, the dependent, independent and control variables are introduced and evaluated thoroughly and finally, a descriptive analysis on the sample is performed.

3.1 Study Area

According to Hysing (2009), the selection of a proper study area for geographical research is very important so as to commit a substantial, theoretical analysis. As a consequence, the Netherlands is selected to conduct an investigation of attitudes towards public transportation for the following reasons. Firstly, the Netherlands is an ideal location for the study of modal choice perceptions and sustainable transportation because of the transport system and the socio-demographic elements. Furthermore, the Netherlands, in contrast with other countries, is a pioneer in the research of people's travel behavior having already set the foundations for studies like the current one. For instance, in 2012, the Ministry of Infrastructure and the Environment demonstrated its vision for 2040 (Ministerie van Infrastructuur en Milieu, 2012). Its main goal is to enhance the accessibility of the Dutch mobility system and trigger the citizens to use more sustainable modes of transportation connecting services, behavior and technology (Ministerie van Infrastructuur en Milieu, 2012).

The 'Beter Benutten' ('Optimising Use') program investigates people's travel behavior and it is mainly focused on how individuals can change their travel behavior without the government being obliged to expand the existing infrastructure. Via the "Beter Benutten" program, the Dutch government desires to get a better insight of individuals' travel behavior and the factors that influence their decision to alter this behavior. This knowledge could be used to stimulate a modal shift away from car. It all starts with a good understanding of current and desired behavior, then tailor intervention based on previous findings and finally, investment in monitoring and evaluating (Platform Beter Benutten, 2016).

3.1.1 The Netherlands: an introduction

The western part of the Netherlands has more than one hubs with Amsterdam, Rotterdam, The Hague and Utrecht forming the major conurbation, famous as Randstad (or 'edge city') where most of the economic activity is held. This part's population is approximately 7 million inhabitants accounting for roughly 41% of the total population of the country and has an average population density of almost 1,000 inh. /km^2 (van de Velde et al, 2016). The Netherlands is also known for the big differences between town and country: areas with high urbanity areas on the one hand and rural parts on the other. One of the main future plans of the Dutch government is to attract people to move to more urban areas, decreasing the number of citizens who live in more urban ones.

Therefore, public transportation is the key player in this effort (Management Ministry of Transport Public Works and Water, 2010).

Similarly to the other European countries, Dutch citizens are using more and more the car to cover their daily mobility needs. The road network is gradually reaching the limits of its capacity, especially during the morning, making public transportation and the bicycle part of the solution. In a daily base 4.5 million trips are due to bus, tram and metro, one million are made by train and more than 14.5 million by bicycle (Management Ministry of Transport Public Works and Water, 2010). However, the Netherlands is characterized by major differences by region. In highly urbanized cities public transport constitutes 40% to 50% of the total journeys and especially in the main area of Amsterdam half of the trips are made by public transport or bicycle (Management Ministry of Transport Public Works and Water, 2010). Last but not least, one of the key features of the Dutch public transit is the integration of services. Throughout the decades, the public transportation system came to operate as one system supported by integrate ticketing (van de Velde et al, 2016).

3.1.2 History of public transportation in the Netherlands: a brief description

In the Netherlands, public transportation dates back from the 17th century when people were transferred by horses or track boats (via canals) as connection among the major towns. Later, they constructed way for buses and (steam) trams while, in the meantime, the trains had arrived in the beginning under the management of different transport firms and then merged into one train operator (Dutch Railways or NS) in 1929. In a regional level, this concentration started in the 1960s.After 20 years, all the local and regional transport companies had belonged to one holding organization. Only in nine large cities there was a separate urban transport company. The Netherlands' long tradition in public transportation has brought important innovations and global thinking on this field. Some examples are the national fare system for local and regional public transit in 1980, the national public transport season ticket for the students in 1991 and one national telephone number for all public transport information in 1992 (Management Ministry of Transport Public Works and Water,2010).

Currently, area (or line)-based concessions awarded by the government shape the Dutch public transport: the central governmental authorities award the concessions for the mainline rail network, the local authorities for local rail transport and the regional authorities for urban and regional transport (bus, tram and metro). After the decentralization of the powers and responsibilities, the transport system seems to work more properly as the regional authorities can have a better insight of regional needs. The central government provides the local authorities with a certain budget to be spent on running urban public transport. Stronger bonds between the citizens and the local public transport have been developed and the regions have obtained their own identity (Management Ministry of Transport Public Works and Water, 2010).

3.1.3 The Netherlands public transport: A sustainable transport future?

In all of the major Dutch cities have been constructed a widespread and inexpensive transportation system. This is the result of the high degree of urbanization leading many Dutch cities to develop a significant public transportation network which allows people to utilize cars less extensively. The rail system in the big cities (such as Amsterdam, Rotterdam and The Hague) seems to work properly in general. Trains operate frequently in such a way that they almost perform as a metro-system, particularly during the day. Furthermore, huge investments in public transportation infrastructure have been fulfilled in almost all Dutch cities increasing the appeal and status of traveling by public transportation and integrating different transportation modes at stations, for instance cycling. A significant achievement is the recent development of the metro-system between The Hague and Rotterdam, connecting these cities together (Stead et al., 2015)

In rural areas a redesign of public transportation took place by integrating more bus and train services. Direct but low and less frequent bus services between the rural areas and the nearby city have been replaced by bus services connected directly to the local train line every 30 minutes. Total travel time was declined and frequencies increased. These main lines are the backbone of the regional public transport system and they are connected with less busy lines playing the role of "feeders" for the main connections. The utilization of these types of transport systems have enabled many small villages to retain their public transport connections, and by this way the primary goal of public transport in rural areas have been achieved; offer the opportunity to individuals being dependent on public transportation to travel (Van de Velde et al., 2016).

An important indicator for public transport quality is customer satisfaction. Annually, in the Netherlands is conducted a research to define customer satisfaction in public transport. The 'public transport customer barometer' estimates people's opinions on public transportation. They rate different aspects of their trip, for instance the opportunity to find a seat or the feeling of security (Management Ministry of Transport Public Works and Water, 2010)

Table 3-1: Customer satisfaction 2009 (Management Ministry of Transport Public Works and Water, 2010)

Aspects	2004	2005	2006	2007	2008	2009
General appreciation	7,1	7	7	7	7,2	7,2
Information and safety	7,4	7,2	7,4	7,3	7,5	7,5
Comfort	7,1	7	7	7	7,2	7,2
Punctuality and speed	6,3	6,1	6,2	6	6,2	6,5
Price	6,2	6	6,3	6,3	6,5	6,3

Table 3-1 illustrates that customer rating has enhanced in every aspect from 2004 to 2009. It seems that people rate higher the information provided and safety as well as comfort and they rate lower punctuality, speed and price. Additionally, there are differences in customer rating between urban and rural areas. Public transport services in less urbanized cities score slightly higher than in the largest cities. More specifically, public transport in urban areas scores higher on travel time and frequency and lower on safety, whereas public transport in rural areas scores higher on the opportunity of a seat and comfort and lower on frequency (Management Ministry of Transport Public Works and Water, 2010)

Central and regional governments have collaborated with the public transport providers to develop a vision regarding public transport's role in the mobility system in 2040. This strategy is focused mainly on how the systems permitting individuals to be transported from area A to B will improve their speed, comfort and reliability. So, it is of high importance an integrated mobility system and an innovative plan for public transport. Dutch government aims to provide accessibility for a large group of people in urban areas and fast, door-to-door connections between urban areas that are further from the city centers (Management Ministry of Transport Public Works and Water, 2010).

The public transport, consequently, must be an attractive form of travel towards sustainability. Dutch Railways (NS) and ProRail (the rail infrastructure provider) targets to alter to 100% green power in 2019. From 2025 onwards, new emission-free buses will be introduced in the Netherlands and in 2030 all the buses will be emission-free. The “sustainability plan” will be enforced more by the usage of environmentally friendly infrastructure and material. Policy makers will establish regulations on sustainability of mobility. This means that public transport providers should meet the proper conditions, form a climate in which all the parties can share their knowledge and integrate their systems to be averted needless transport movements (Management Ministry of Transport Public Works and Water, 2010).

3.2 The Netherlands Mobility Panel (MPN)

This thesis uses data from The Netherlands Mobility Panel (MPN) which is a longitudinal research that links the travel behavior of individuals and households dynamically over time as well as how changes in travel behavior, personal and household attributes and other elements influence mobility. This panel includes a household survey, a personal survey and a three-day mobility diary with more than 6,000 participants in almost 2,000 households (around 4,000 participants have a complete personal survey, household survey and mobility diary). The data had been gathered in four consecutive years (2013-2016). Data from second wave (2014) are used to answer the main research question where the number of respondents account for approximately 5,100 (Hoogendoorn-Lanser et al., 2015). The reason why the second wave is chosen to be analyzed is merely because people’s perceptions about different modes of transportation are only available in the second wave and not in the first one.

The participants enter online information concerning locations, activities and trips via location-based diaries. Respondents are questioned in a certain order, which is called “routing”, and the order being followed relies on the participant’s answers. The routing is split into a variety of blocks and each block contains its own flowchart and explanation giving the connection for the question-answer procedure. Five types of information are gathered to be supported the main goal of MPN: information regarding mobility, personal and household attributes, mobility elements on personal and household levels, factors that influence mobility (life-events, attitudes and spatial dynamics) and more general information. The participants must provide information about all trips and trip-stages that have fulfilled during three consecutive days as well as the motivations behind this choice on the web-based diary. The answer categories and the diary's variables are given to the individuals. The diary was designed in a way that participants can fill in it chronologically for every day (Hoogendoorn-Lanser et al., 2015).

The main focus of this paper is on the variables extracted by the personal questionnaire and not from the diary. The personal questionnaire defines personal characteristics for instance, age, gender, monthly salary, preferred mode of transport or the impact of ICT use mobility. The dataset being used mainly consists of different households where each household may include one person being the main income partner or more than one person being partner of the main income partner, the child of main income partner or other family people. Before initiating the analysis, it is decided to keep only the main income partner and his/her partner (excluding the rest members of the family) to extract valid and accurate results. Then, because of performing a cross-sectional study with the main focus to be on the data from the second wave (2014) and not from the first one (2013), the data concerning only the year of 2014 have been isolated. After making the sample more concrete and specific to the needs of this study, these participants who did not complete the questionnaire are excluded. Finally, only one observation per household is kept since it is not desired to have multiple observations from the same household. After all these amendments, the sample is reduced to 1604 observations.

3.3 Description of the variables

The variables used in this thesis are mainly people's opinions towards different aspects of public transportation. The dependent, independent and control variables used to answer the main research question are going to be described.

3.3.1 Dependent variable

GEBRUIK_BTM: In the dataset provided, the dependent variable GEBRUIK_BTM is an ordinal variable which shows how frequently the respondents use the public transportation in the Netherlands and takes values from 1 to 7 (1 "4 or more days per week"; 2 "1 to 3 days per week"; 3 "1 to 3 days per month"; 4 "6 to 11 days per year"; 5 "1 to 5 days per year"; 6 "less than 1 day per year" and 7 "Never".

Yet, the dependent variable must provide binary outcomes taking values 1 for respondents who use public transportation and 0 for non-users of public transportation (those respondents may utilize alternative modes of transportation, namely cars). Consequently, a new, binary variable **PT_USERS** is created taking values 1 for people who use public transportation 4 or more days per week and 1 to 3 days per week and values 0 for those who belong to the rest categories.

3.3.2 Independent variables

Likert scale is considered the most popular technique to measure people's attitudes. Likert R. (1932) was the first who proposed this scale to measure data referring to people's attitudes towards a single object. In this scale proposed by Likert, each item corresponds to a response category- 'Agree strongly,' 'Agree,' 'Neither agree nor disagree,' 'Disagree,' or 'Disagree strongly'- so as to capture person's degree of agreement with a declaration about the object. Likert scale usually contains five response categories, although sometimes it can be encountered the existence of Likert scale with seven response categories.

In the dataset, the independent variables contain either 6 or 7 items linked to a response category. Half of the independent variables have a direct relationship with public transportation. In other words, they describe people's attitudes towards public transportation. Yet, due to limitation in the available variables showing commuters' attitudes towards public transportation, it is going to be utilized variables which describe people's opinion towards car. For instance, variable *AUTO_STELLING12* indicates people's opinion towards the statement "A car says a lot about someone's personal taste / sense of style". It is assumed that people who disagree with this statement believe that "public transportation says a lot about someone's personal taste/style". As a consequence, all the variables who are indirectly associated with public transportation will be treated similarly.

From the question "How do you feel about travelling by bus, tram or metro? I find travelling by bus, tram or metro:" the first group of variables was formed (COMFORT, RELAXATION, TIME, SAFETY, FLEXIBILITY, PLEASURE and PRESTIGE). For the next group of variables, people were asked their opinion about: "a car says a lot about someone's personal taste / sense of style" (AUTO_STELLING12), "a car says a lot about a person's status in society" (AUTO_STELLING15), "a car gives me the freedom to go wherever I want" (AUTO_STELLING01) and "due to costs, I opt to travel by public transport and bicycle instead of by car" (PRICE).

As it was referred, variables AUTO_STELLING12, AUTO_STELLING15 and AUTO_STELLING01 detect people's opinion regarding car. It is assumed that if people disagree with the statement being represented by each variable, they will agree that, for instance, public transportation gives them the freedom to go whenever they want. Consequently, new variables are created depicting respondents' opinion towards public transportation. The new variables will retain their Likert scale nature taking values from 1 to 5 (1 strongly disagree; 2 disagree; 3 neutral; 4 Agree; 5 strongly agree).

Independent variables COMFORT, RELAXATION, TIME, SAFETY, FLEXIBILITY, PLEASURE, PRESTIGE, FREEDOM and PRICE are measured in a Likert scale of 6 items where value 6 represents the statement "No opinion". Since those variables already contain the statement "Neutral" represented by value 3 and the rest of the independent variables contain 5 items, it has been decided to exclude from the sample those who state "No opinion". A sample is considered representative and adequate when it also includes those individuals who do not have an opinion about a certain statement. This can be achieved via the option "Neutral" and that is why "No opinion" observations are dropped. Consequently, after this assumption, the sample contains 1,167 observations. Table 3-2 provides an in-depth description of the independent variables.

Table 3-2: Description of the independent variables

Variable	Description of variable
COMFORT	people's opinion regarding **comfort** such as ease of traveling with children and/or heavy baggage, available space, comfortable seats (1=strongly disagree,6=no opinion)
RELAXATION	people's opinion regarding the feeling of **relaxation** (less anxiety, read or nap) (1=strongly disagree,6=no opinion)
TIME	people's opinion regarding the feeling that travelling by public transportation **saves them time** (traffic jam or lack of parking spots) (1=strongly disagree,6=no opinion)
SAFETY	people's opinion regarding **safety** (cannot be stolen or less accidents) (1=strongly disagree,6=no opinion)
FLEXIBILITY	people's opinion regarding **flexibility** (always available, spontaneous utilization) (1=strongly disagree,6=no opinion)
PLEASURE	people's opinion regarding the **feeling of pleasure** whilst travelling with public transportation (1=strongly disagree,6=no opinion)
PRESTIGE	people's opinion regarding the feeling that travelling by public transportation gives them **prestige** (1=strongly disagree,6=no opinion)
TASTE	people's opinion regarding the feeling that public transportation **says a lot about someone's personal taste / sense of style** (1=strongly disagree,5=strongly agree)
STATUS	people's opinion regarding the feeling that public transportation **says a lot about a person's status in society** (1=strongly disagree,5=strongly agree)
FREEDOM	people's opinion the feeling that public transportation **"gives me the freedom to go wherever I want"** (1=strongly disagree,6=no opinion)
PRICE	commuters' perception concerning the **price of public transportation**(expectation about a logical price compared to the service they think it is actually supplied) (1=strongly disagree,6=no opinion)

3.3.3 Control variables

As it was described in the literature review, there are other factors besides people's opinions about public transportation that may influence their intention to use this mode of transportation such as sociodemographic factors or trip characteristics. Although the predominant focus of this paper is on variables expressing individuals' perceptions towards public transportation, control variables are included in the analysis to secure internal validity and accurate results. More specifically, in any research or experiment it is almost impossible to account for all the variables that may influence the result of the research. By adding control variables, it is ensured that variables having potential influence on the dependent variable are not omitted.

Control variables being possibly predictive of the result under investigation are contained in the binary logistic regression to observe if and how they alter the effect of the independent variables in the analysis. These are age, annual income, gender, employment status of the participant, level of education and level of urbanization.

AGE: Ordinal variable taking values from 1 to 12 and indicating the age of the participants for example 30-39 years old, 60-69 years old or 70-79 years old. Since this variable contains a high number of levels, it is treated as a continuous variable in the logistic regression analysis.

INCOME: Categorical variable taking values from 1 to 7 and illustrating the gross income/household, for example minimum (<12,500) or below the national benchmark income (12,500-<26,200). It is observed that each of these seven categories can be grouped together and form four major levels: 1=Low income (minimum (<12,500) and below the national benchmark income (12,500-<26,200)); 2=Average income (national benchmark income (26,200-<38,800)); 3=High income (1-2x the national benchmark income (38,800-<65,000), 2x the national benchmark income (65,000-<77,500) and more than 2x the national benchmark income (>=77,500)) ; 4=Unknown. The criteria for this classification is that if a person earns below or equal to the national benchmark income is considered as low- income employee, equal to the national benchmark income is considered as an average-income employee and higher than the national benchmark income is considered as a high-income employee.

GENDER: Binary variable taking values of 1 (male) and 0 (female) representing the gender of the participants.

EMPLOYM_STAT: Categorical variable taking values from 1 to 12 and representing the employment status of person such as student\attending school or employed non-governmental job. From the twelve categories, it is formed four new categories as following: 1=Employed (self-employed entrepreneur, employed non-governmental job, employed by the government); 2=Unemployed (occupational disability/unfit to work, unemployed\searching for a job\on social welfare, retired or taken early retirement); 3=Student (student\attending school); 4=other (for the rest of the categories).

EDUCATION: Ordinal variable with values ranging from 1 to 12 and indicating highest completed education level for example primary education Bachelor's degree or

University Master's. The variable is transformed to binary variable with 1=Low education (no education, primary education, LBO \ VBO \ VMBO, MAVO\1st 3 years HAVO-VWO\VMBO, MBO, HAVO and VWO); 0= High education (HBO\WO (Bachelor's degree) and University Master's or doctoral degree). Nowadays, people having a diploma from high school or lower are considered as low-educated whereas people having a bachelor degree and higher are considered as high-educated.

URBAN: Categorical variable with values ranging from 1 to 5 and indicating level of urbanization for example very highly urbanized (2500 or more inhabitants/km²) or low urbanization (500 to 1000 inhabitants/km²). From the five categories, it is forms three new categories, as following: 1= Highly urbanized (cities with 1500 and more inhabitants/km²); 2= Moderately urbanized (1000 to 1500 inhabitants/km²); 3= Low urbanized (1000 and less inhabitants/km²)

Table 3-3 summarizes the control variables used in the binary logistic regression.

Table 3-3: Description of the control variables

Variable	Description of the variable
AGE	Continuous variable taking values from 18 years old and higher indicating the **age** of the sample
INCOME	Categorical variable indicating the **gross annual income** of the sample(1=Low income;2=Average income;3=High income;4=Unknown)
GENDER	Binary variable defining the **gender** of the sample (1=male;0=female)
EMPLOYM_STAT	Categorical variable indicating the **employment status** of the sample(1=Employed;2=Unemployed;3=Student;4=Other)
EDUCATION	Binary variable defining the **highest completed education level** of the sample (1=Low education;0=High education)
URBAN	Categorical variable indicating **level of urbanization** (1=Highly urbanized, urban areas;2=Moderately urbanized areas;3=Low urbanized, rural areas)

3.4 Descriptive statistics

Before getting into more detailed analytics and statistical modelling, it is crucial to comprehend the data and its distribution at a higher level. A frequency distribution table for the dependent and the independent variables gives a better insight of the categorical predictors in the data set while plots provide graphical representations of the sociodemographic characteristics of the sample.

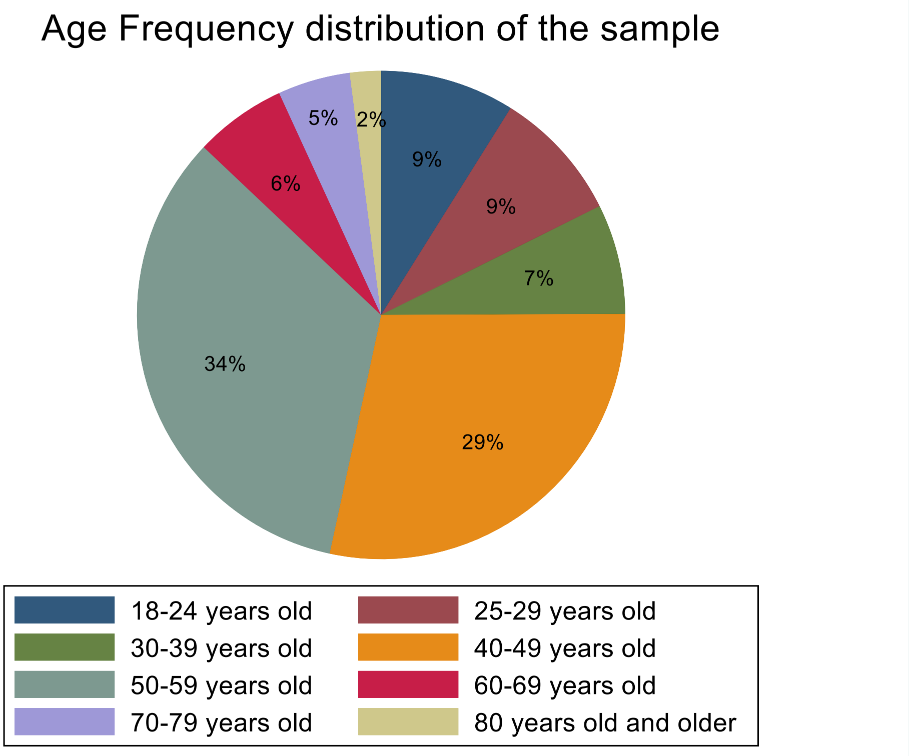

Figure 3-1: Age Frequency distribution of sample

According to Figure 3-1, 34% of the sample are from 50-59 years old while 29% are between 40 and 49 years old. The least number of the participants are around 80 years and older. According to Statista (2018), "on January 1, 2018 there were roughly 3.8 individuals younger than 20 years old while the largest age groups was defined by those between 40 and 65 years old accounting for approximately 6 million people" in the Netherlands. These statistical evidences match with the age group of the sample since the majority of the respondents are between 40 and 60 years old making the sample representative of the population.

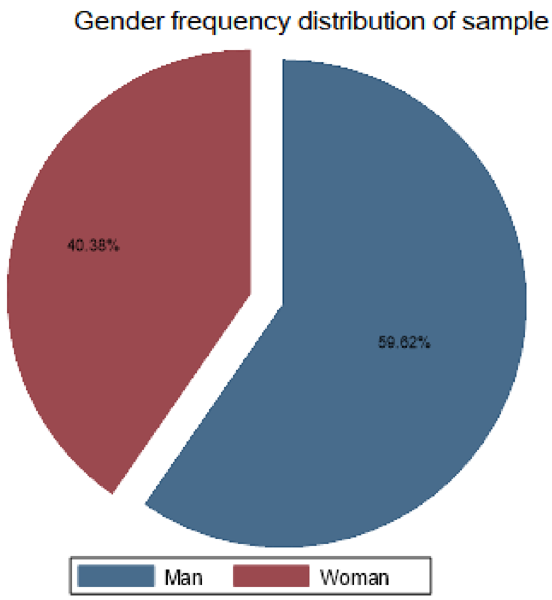

Figure 3-2: Gender frequency distribution of sample

Figure 3-2 specifies that the majority of the sample are men accounting for 60% of the total number of participants and the rest are women. This disproportion between male and female respondents seems to be plausible since, in the beginning of this analysis, only the main income partner/household was kept and usually, the main income partners are the men.

Based on Figure 3-3, the majority of the respondents (roughly 60% of the total) gain twice or more the average income (from 26,000 to 39,000 euros) in an annual base. Moreover, approximately 20% of the survey sample are low-income employees while almost 12% of the respondents earn the average salary annually. It is of high interest the fact that a significant amount of the respondents (almost 20%) did not state their income. It is possible that those participants are high-income employees tending not to reveal their income due to societal insecurity.

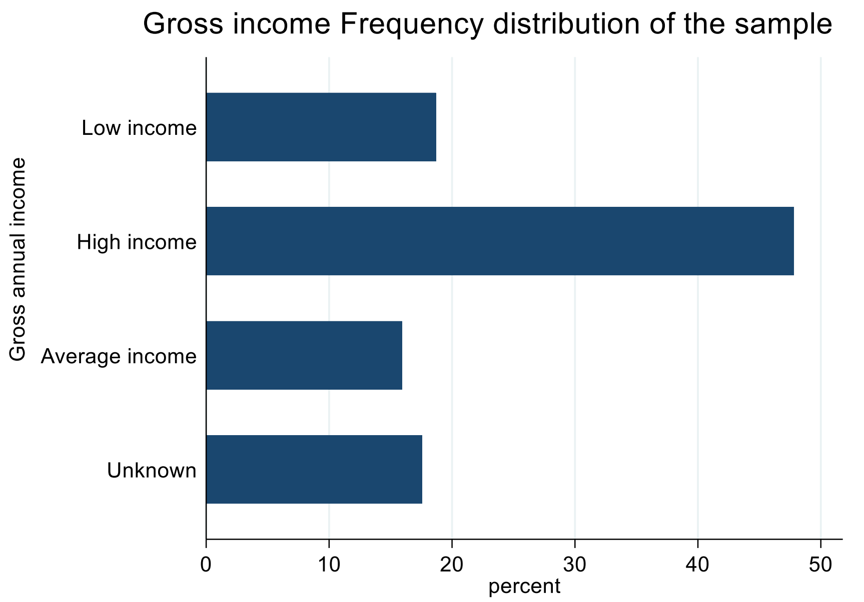

Figure 3-3: Gross income Frequency distribution of sample

In 2017, Dutch employees aged between 50 and 54 years old earned 44,200 euros per year on average, while people aged between 30 and 34 years old gained the average annual income being approximately 35,000 euros (Statista, 2017). It is observed that the sample have the same characteristics as the population since the majority of the respondents are between 40 and 60 years old and they are high-income employees.

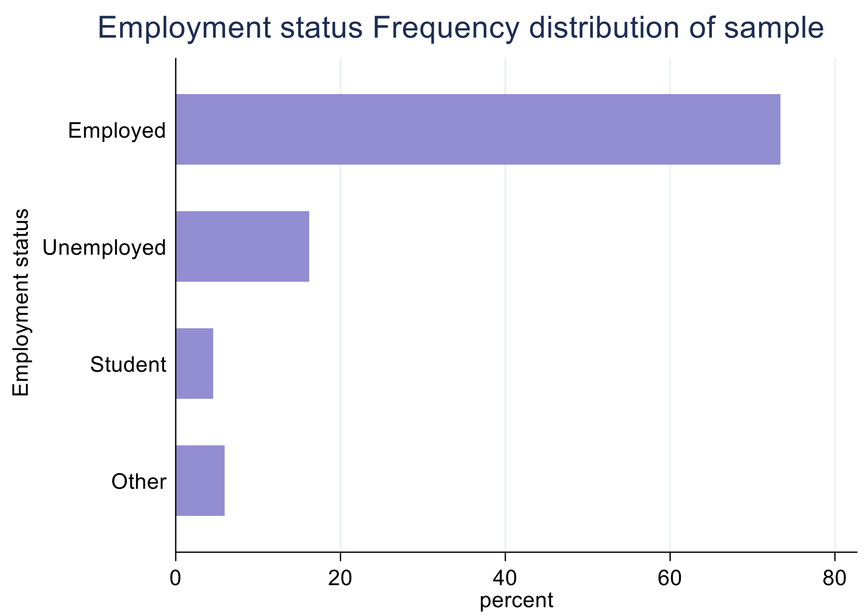

Figure 3-4: Employment status Frequency distribution of sample

Based on Figure 3-4, almost 80% of the sample are employed whilst only roughly 18% and 10% are unemployed and students respectively. These evidences seem to be logical taking into consideration the low unemployment rate in the Netherlands being 4.3% in 2018 (Statista, 2018).

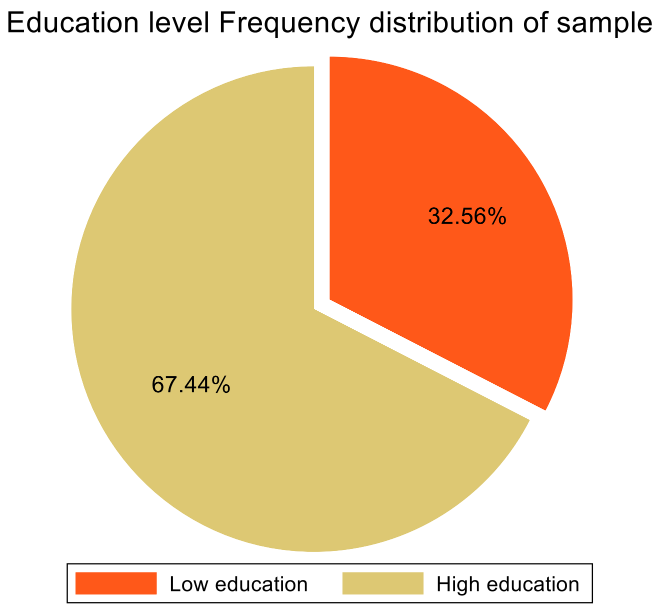

Figure 3-5: Highest completed education level Frequency distribution of sample

The majority of the respondents are highly educated meaning that they have obtained a Bachelor or Master/doctoral degree (Figure 3-5). This seems to be plausible based on the previous findings where the participants are high-income employees and generally, based on the trend of the latest decades where people tend to obtain Bachelor or Master diplomas to secure a more convenient, wealthier lifestyle. This situation can be also supported by the fact that education level in the Netherlands is considered as one of the most qualitative worldwide urging individuals to gain a more academic knowledge.

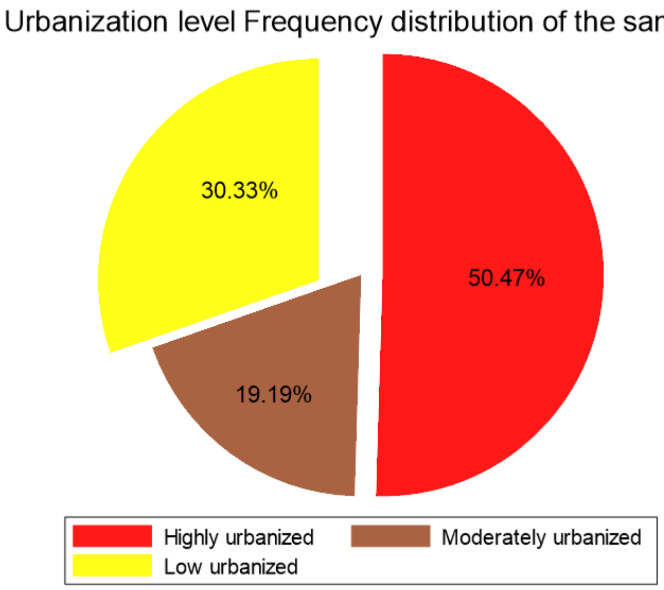

Figure 3-6: Urbanization level Frequency distribution of sample

According to Figure 3-6, roughly 55% of the individuals live in very highly or highly urbanized areas in the Netherlands whilst the rest of them inhabit in lower urbanized cities.

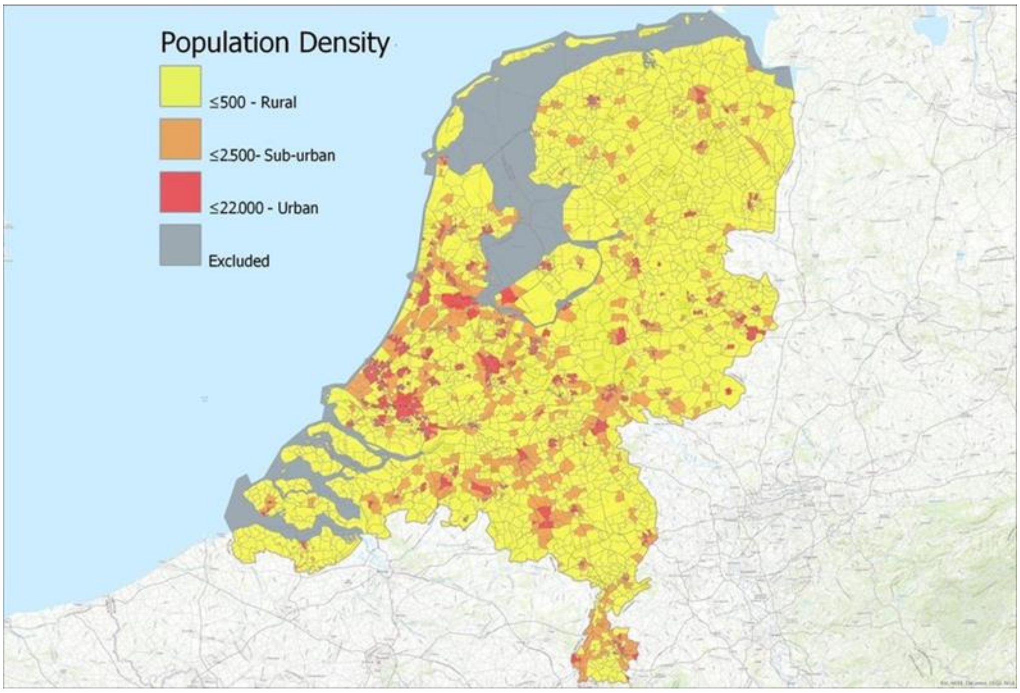

Figure 3-7: Map division in urban, suburban and rural areas in the Netherlands based on population density (Moraitis et al., 2018)

Figure 3-7 indicates that the most urbanized areas are Amsterdam, Rotterdam and Hague while the least urbanized cities are Tilburg and Groningen. Consequently, most of the participants inhibit in one of these three highly urbanized cities.

According to Appendix 1 Table 1, the majority of the participants have a neutral attitude towards different attributes of public transportation whilst a large portion of the respondents seem to express a negative opinion towards this mode of transportation. Regarding the use or not of public transportation, 90% of the respondents declare that they are not using public transportation often or almost never while only 10% of the sample are frequent users of this mode. Additionally, concerning the different aspects of public transportation, only safety is evaluated positively since 55% of the individuals find public transportation to be safe. Finally, 48% of the participants believe that public transportation says a lot about a person's status in society. This statement is of great interest since it can have both positive and negative interpretation depending on each person’s angle.

To sum up, participants evaluate either neutrally or negatively different aspects of public transportation with safety to be the only attribute where people state their positive feeling. Combining the sociodemographic characteristics of the sample and the literature review as far as factors influencing the use of public transportation are concerned, it can be observed that most of the respondents are educated, middle-aged men earning a significant amount of money in an annual base. These elements can urge people to utilize more often their cars as their preferred mode of transportation since, from a financial perspective, they may possess more than one car or, from a societal perspective, cars may give them prestige or higher social status. This can be verified by the fact that only 10% of the sample utilize quite often public transportation whilst the majority prefer travelling by car.

Furthermore, the majority of the respondents live in urbanized areas making the use of public transportation an ideal alternative compared to the car because of the traffic jam or lack of parking spots. Yet, individuals evaluate negatively or even neutrally different attributes of public transportation and they preferring using the car raising the question if, eventually, policy makers or the government have achieved to make public transportation an attractive mode of transportation concerning flexibility, comfort, price or pleasure. This case is examined in the next sections of this thesis.

Chapter 4: Methodology

After analyzing why the Netherlands is considered an ideal location for the study of modal choice perceptions and sustainable transportation, describing the variables utilized in this paper and conducting a descriptive analysis on the sample, this section describes the methodology used to answer the main research question. The statistical tool used for all the analyses in this paper is Stata. Based on a previous research of Tyrinopoulos et al. (2008), where factor analysis and ordered logit modelling are applied to analyze how people's behavior and their level of satisfaction varies from the utilization of diverse transit systems, this paper follows similar steps to extract the desired outcomes.

Firstly, a factor analysis is conducted. The main goal of performing a factor analysis is to decrease a large number of items (variables) into fewer number of factors. For this study, the eleven independent variables can be grouped into smaller factors based on the theory which demands the existence of two main group of factors namely people's perceptions about the instrumental aspects of public transportation and people's perceptions about the symbolic-affective aspects of public transportation. The second part of this section mainly focuses on a binary logistics regression investigating which of these two factors have a stronger influence on the dependent variable. That is, by conducting a binary logistics regression the main research question is answered and valuable results for discussion are extracted.

4.1 Factor Analysis

Factor analysis can effectively explore combination of variables that represent certain factors. It is a method that detects clusters of correlated variables measuring together an underlying dimension. As a result, a smaller group of factors maintains the original interrelated variables. According to Janssens et al. (2008, p.245), a factor analysis leads to "the strength of the association between the variables which is important, to the extent that it is possible to define a smaller set of dimensions, each of which is based on a number of the original variables, while still keeping the majority of the information."

The ultimate goal is to discover group of variables that are highly correlated within the group but are not correlated with other variables outside the group. First of all, factor analysis is used mainly to comprehend and investigate how a latent variable is structured based on a batch of variables. Furthermore, it is a method to evaluate the underline dimensions with a formed questionnaire. Last but not least, factor analysis is applied to decrease the dataset while retaining it manageable and dependable on original information. (Field, 2009).

There are two main types of factor analysis namely Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). The main difference between those two approaches is that EFA is used to investigate the possibility of the existence of underlying factor structure of a set of items without requiring a predetermined structure on the result. On the other hand, the researchers utilizing CFA to explore these underlying factors of a set of variables had already presupposed the pattern a priory based on theoretical or empirical research and then examine the hypothesis statistically. Generally, most broadly method used in the behavioral sector is EFA since it is hard to have a strong theoretical base to support the existence of only a few factors (Field, 2009). That is why EFA analysis is applied to this paper.

4.1.1 Assumptions

The data should meet several assumptions to conduct an exploratory factor analysis. The first assumption is related with the sample size. A sample size of 100-200 participants is considered as appropriate to perform factor analysis (Chandler et al., 2011). The sample used in this thesis has a size of 1167 participants being sufficient. Additionally, it is necessary to extract outcomes from the correlation matrix, the 'Bartlett's test of sphericity' and the 'Kaiser-Meyer-Olkin measure of sampling adequacy' to get a better insight of the degree of correlation provided (Janssens et al., 2008).

Specifically, the correlation matrix displays the relationship between the individual variables and indicates whether the variables do not correlate too highly or too lowly with other variables. If the variables are highly correlated ($r > 0.8$ or $r < -0.8$), then it is impossible to find a factor while if the variables correlate lowly ($-0.3 < r < 0.3$), then there is a probability that the variables do not measure the same factor as the others

(Field, 2009). Hair et al. (1995) categorized these loadings using a rule of thumb as ±0.30=minimal, ±0.40=important, and ±.50=practically significant.

Table 4-1: Correlation matrix for factor analysis

	FRED	STAT	TASTE	PRICE	COMF	RELAX	TIME	SAF	FLEX	PLEAS	PREST
FRED	1	0.1590	0.2694	0.0234	0.0227	0.0221	0.0298	-0.0063	0.0009	0.0117	0.0649
STAT		1	0.5644	-0.0486	0.0126	-0.0221	-0.0505	0.0554	-0.0579	0.0063	-0.1733
TASTE			1	0.0033	0.0053	0.0154	-0.0045	0.0164	-0.0288	0.0010	-0.0607
PRICE				1	0.2072	0.1939	0.2891	0.0852	0.2528	0.2318	0.1518
COMF					1	0.7746	0.5561	0.4476	0.5835	0.7605	0.3610
RELAX						1	0.5257	0.4206	0.5468	0.7694	0.3995
TIME							1	0.2849	0.7159	0.5762	0.3610
SAF								1	0.3272	0.4382	0.1484
FLEX									1	0.6175	0.3386
PLEAS										1	0.4114
PREST											1

Table 4-1 suggests that the majority of the correlation coefficients are greater than 0.3 and lower than 0.8 in absolute value so they are indicative of acceptable correlations.

Additionally, the Kaiser-Meyer-Olkin (KMO) test is used to evaluate whether the data may be grouped into smaller set of factors and it shows the proportion of the variance in the variables that might be explained by underlying factors (Field, 2009). According to Field (2009, p. 647) “values between 0,5 and 0,7 are mediocre, values between 0,7 and 0,8 are good, values between 0,8 and 0,9 are great and values above 0,9 are superb” to perform factor analysis.

According to Table 4-2, the KMO value of the participants is 0.84 which means that 84% of variability in the variables can be explained by some underlying factors. As it was referred, closer to 1 means that the data is suitable for conducting factor analysis. Going deeper to the analysis and comparing the partial correlations among variables individually, it is observed that there are not independent variables with a KMO value lower than 0.5

Table 4-2: KMO measure of sampling adequacy

Kaiser-Meyer-Olkin measure of sampling adequacy	
VARIABLE	**kmo**
FREEDOM	0.5488
STATUS	0.5963
TASTE	0.6154
PRICE	0.9032
COMFORT	0.8912
RELAXATION	0.8573
TIME	0.8545
SAFETY	0.9483
FLEXIBILITY	0.8573
PLEASURE	0.9008
PRESTIGE	0.9293
Overall	**0.8391**

Finally, Bartlett's test of sphericity attempts to determine whether the correlation matrix is an identity matrix, which means that the variables are unrelated and uncorrelated. In an identity matrix, the variables have not significant correlations among them, therefore there are no possible common factors.

The following hypothesis needs to be constructed (Field, 2009). The null hypothesis is rejected when p-value<0.05

H_0: No correlation among the variables

$H_{1:}$ Correlation among the variables

Table 4-3: Bartlett test of sphericity

Bartlett test of sphericity	
Chi-square	5949.242
Degrees of freedom	55
p-value	0.000
H_0: variables are not intercorrelated	

Table 4-3 depicts that there is correlation among the variables (p-value<0.05) and so there are factors that can be pulled out by using factor analysis.

4.1.2 Factor extraction

The first step to the analysis is to extract the initial number of factors. Two main methods exist in order to discover the initial factor loadings: the principal component analysis and the principal (axis) factoring analysis. The difference between these two methods lies to the fact that the principal component analysis focuses on how to reduce the number of items while principal factoring analysis focuses on how to detect the structure of the data. In most of the cases, both techniques lead to identical results so principal factoring analysis is preferred as it seems theoretically to be used more often by the researchers (Netemeyer et al., 2003)

There is not a solid base to determine the amount of factors. According to Janssens et al. (2008) there are two fundamental criterions to determine the number of factors governing a set of variables: the location of the elbow in the “Scree plot” and the “Kaiser criterion”. Separately these two measures provide an indication but together with the a priori expectation can give a strong insight. The K1 method suggested by Kaiser (1960) is the most popular and widely utilized in practice. According to this rule of thumbs, only the factors that have eigenvalues greater than one are kept for further analysis and are used as new variables in the model. Eigenvalues show the total variance accounted for by one of these factors.

Table 4-4: Factor analysis-eigenvalues with 11 independent variables

Factor analysis/correlation			Number of obs = 1,167	
Method: principal-component factors			Retained factors = 2	
Rotation: (unrotated)			Number of params = 17	
Factor	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
FACTOR1	4.44261	2.45995	0.4039	0.4039
FACTOR2	1.98266	1.07104	0.1802	0.5841
FACTOR3	0.91162	0.10672	0.0829	0.6670
FACTOR4	0.80491	0.10857	0.0732	0.7402
FACTOR5	0.69633	0.07407	0.0633	0.8035
FACTOR6	0.62226	0.12456	0.0566	0.8600
FACTOR7	0.49770	0.17092	0.0452	0.9053
FACTOR8	0.32678	0.04571	0.0297	0.9350
FACTOR9	0.28106	0.04640	0.0256	0.9605
FACTOR10	0.23467	0.03526	0.0213	0.9819
FACTOR11	0.19940	.	0.0181	10.000
LR test independence vs saturated : chi2(55)=5954.36 Prob>chi2 = 0.0000				

Two factors load eigenvalues above 1 explaining together 59% of total variance (Table 4-4)

The “Scree plot” is also implemented to determine the number of factors closer to the theoretical expectation.

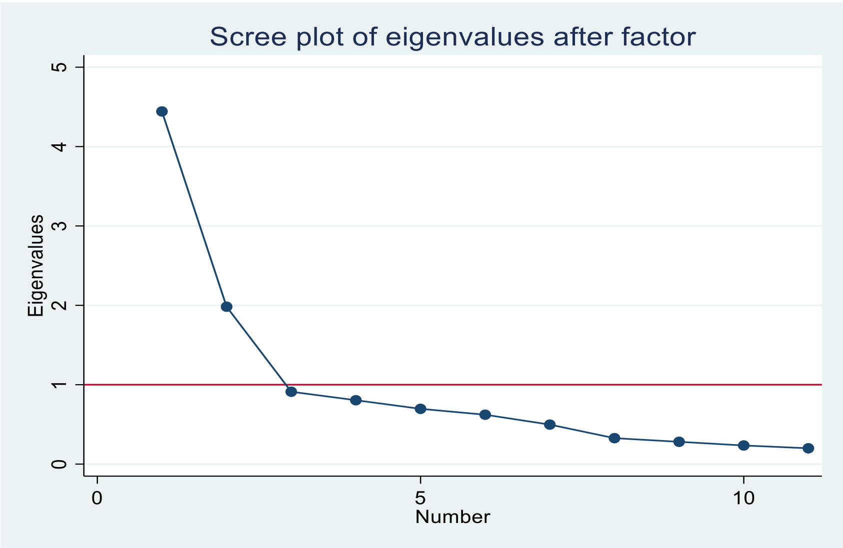

Figure 4-1: Scree plot of eigenvalues after factor analysis

Based on the elbow rule (the point at which the noticeable break in the plot begins), two factors can be maintained (Figure 4-1). As a result, based on theoretical evidences and the "Kaiser criterion", it is concluded that two factors can be retained for further analysis.

Table 4-5: Factor loadings (pattern matrix) and unique variances with 11 independent variables

Factor loadings (pattern matrix) and unique variances			
Variable	**Factor1**	**Factor2**	**Uniqueness**
FREEDOM	-0.0784	0.8896	0.2025
STATUS	-0.0876	0.7641	0.4085
TASTE	-0.1216	0.7462	0.4285
PRICE	0.6379	0.0287	0.5922
COMFORT	0.8589	0.0902	0.2542
RELAXATION	0.8657	0.0862	0.2431
TIME	0.7564	-0.0029	0.4278
SAFETY	0.5447	0.1126	0.6906
FLEXIBILITY	0.7726	-0.0133	0.4030
PLEASURE	0.8751	0.0832	0.2273
PRESTIGE	0.5371	-0.1204	0.6971

In this initial stage of this analysis it is observed that the majority of the independent variables load to the desired factors (Table 4-5). Factor 1 represents "people's perceptions about the instrumental aspects of public transportation" including the below variables:

COMFORT: I find travelling by bus, tram or metro to be comfortable

RELAXATION: I find travelling by bus, tram or metro to be relaxing

TIME: Travelling by bus, tram or metro saves me time

SAFETY: Travelling by bus, tram or metro is safe

FLEXIBILITY: I find travelling by bus, tram or metro to be flexible

PLEASURE: Travelling by bus, tram or metro is pleasurable

PRESTIGE: Travelling by bus, tram or metro gives me prestige

PRICE: Due to costs, I opt to travel by public transport and bicycle instead of by car

Those variables describe profoundly people's perception towards different attributes of public transportation and can be grouped into the first factor. This factor describes people's opinions towards more objective elements of public transportation such as safety and reliability. However, variables PLEASURE and PRESTIGE do not load to the preferred factor namely factor 2. These variables describe more "subjective" opinions towards public transportation and hence they do not belong to a factor depicting more "objective" ones.

There are two ways to handle those two variables; either to include them or to omit them and continue analyzing the model without their influence. If those variables are included, it is possible to obtain unreliable results because the factors would not be representative based on the theoretical framework. Consequently, they are excluded and the total number of independent variables is reduced to nine.

Factor 2 depicts "people's perceptions about the symbolic-affective aspects of public transportation" including the below variables:

FREEDOM: Public transportation says a lot about someone's personal taste / sense of style.

STATUS: Public transportation says a lot about a person's status in society

TASTE: Public transportation "gives me the freedom to go wherever I want"

Those variables describe sufficiently commuters' opinions regarding the symbolic-affective aspects of public transportation for instance the feeling that travelling by public transportation affirms their social status or taste of style. This factor can be described as "subjective" since people state that public transportation can influence their mood (sense of freedom) or it can offer a significant social symbol to express status and power.

Researchers have suggested that the numbers of items per factor can range from three to five for representing a factor (Raubenheimer, 2004). Factor 1 consists of five variables and Factor 2 includes 3 variables being considered as a sufficient number of variables to go further in the analysis.

Table 4-6: Factor analysis- eigenvalues with 9 independent variables

Factor analysis/correlation		Number of obs = 1,167		
Method: principal-component factors		Retained factors = 2		
Rotation: (unrotated)		Number of params = 17		
Factor	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
FACTOR1	3.48646	1.51887	0.3874	0.3874
FACTOR2	1.96760	1.14800	0.2186	0.6060
FACTOR3	0.81960	0.04007	0.0911	0.6971
FACTOR4	0.77953	0.10203	0.0866	0.7837
FACTOR5	0.67750	0.21689	0.0753	0.8590
FACTOR6	0.46061	0.13698	0.0512	0.9101
FACTOR7	0.32363	0.04260	0.0360	0.9461
FACTOR8	0.28103	0.07698	0.0312	0.9773
FACTOR9	0.20405	.	0.0227	10.000
LR test independence vs saturated : chi2(36)=4276.80 Prob>chi2 = 0.0000				

Table 4-6 suggests that, after excluding the two variables not loading to the desired factor, the total variance has increased slightly from 59% to 61%.

Table 4-7: Factor loadings (pattern matrix) and unique variance with 9 independent variables

Factor loadings (pattern matrix) and unique variances			
Variable	**Factor1**	**Factor2**	**Uniqueness**
FREEDOM	-0.0917	0.8933	0.1936
STATUS	-0.0868	0.7568	0.4197
TASTE	-0.1467	0.7515	0.4137
PRICE	0.6517	0.0401	0.5737
COMFORT	0.8582	0.0955	0.2543
RELAXATION	0.8599	0.0941	0.2517
TIME	0.7739	0.0103	0.4009
SAFETY	0.5704	0.1109	0.6623
FLEXIBILITY	0.7899	-0.0031	0.3760

Additionally, Table 4-7 proves that most of the variables have higher loadings to each factor.

4.1.3 Factor rotation

Once the initial factor loadings have been estimated, the factors are rotated. The factor matrix is transformed into a simpler one so as to be more inconvenient for interpretation. That is, each variable has noticeably loadings with only a few factors. Via this way, factors that are easier to interpret can be discovered and to be secured that all variables have high loadings only on one factor.

That is, in rotating the factors, each variable has significant loadings with only a few factors, and if possible with only one. Only variables with factor loadings greater than ±0.3 are included in a factor (Firdaus, 2006). Two types of rotation method can be found, orthogonal and oblique rotation. The rotated factors in orthogonal rotation remain uncorrelated while in oblique rotation they remain correlated. The most popular orthogonal method is called Varimax rotation and it is recommended by many books and scientific papers (Abdi, 2003). Varimax use orthogonal rotations resulting in uncorrelated factors. Varimax tries to minimize the number of variables having high loads on a factor. This ameliorates the interpretability of the factors.

Table 4-8: Factor loadings (pattern matrix) and unique variance after rotation

Factor loadings (pattern matrix) and unique variances			
Variable	**Factor1**	**Factor2**	**Uniqueness**
FREEDOM		0.8980	0.1936
STATUS		0.7617	0.4197
TASTE		0.7626	0.4137
PRICE	0.6524		0.5737
COMFORT	0.8635		0.2543
RELAXATION	0.8650		0.2517
TIME	0.7710		0.4009
SAFETY	0.5788		0.6623
FLEXIBILITY	0.7855		0.3760

Table 4-8 verifies strongly the initial assumptions as far as the existence of two underlying factors and the connection of each variable with the corresponding factor. Indeed, variables regarding people's perceptions about the instrumental aspects of public transportation load to Factor 1 being called "Instrumental" factor whilst people's perceptions about the symbolic-affective aspects of public transportation load to factor 2 being characterized as the "Symbolic-Affective" factor. This fact can be reinforced by the loading plot which graphs the coefficients of each variable for the first factor against the coefficients for the second factor (Figure 4-2)

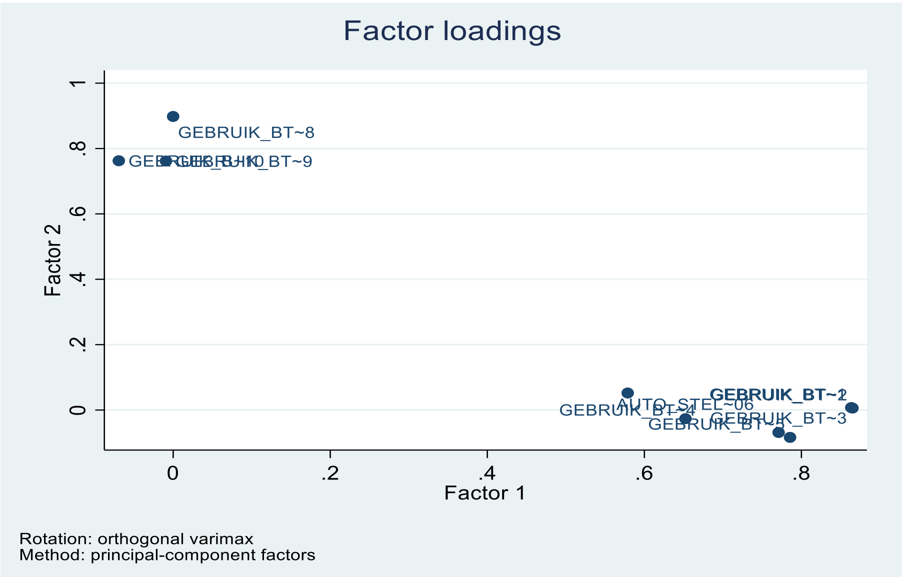

Figure 4-2: Factor loadings after rotation

Loadings can take values from -1 to 1. Loadings close to -1 or 1 suggest that the variable affects significantly the factor while loadings close to 0 indicate that the variable has a weak relationship with the factor. For the variables used in this paper, loadings range from 0.58 (GEBRUIK_BTM_STELLING4) to 0.89 (GEBRUIK_BTM_STELLING9) showing their strong influence on the corresponding factor.

4.1.4 Factor scores

After fulfilling the factor analysis and a model has been fitted, this estimated model can be utilized to estimate predicted values for the factors for any participants, based on the factor loadings of each factor. These predictions are known as "factor scores" and they are basically weighted sums of the values of the observed variables, with the weights defined by the parameters of the model. When the factor score is calculated, those variables that have the higher loadings (stronger relation with the factor) will receive greater weights during this procedure. The most popular method in order to get the factor score is regression where factor loadings are adjusted to take into consideration the initial correlations between the items. That is, it is a method for estimating factor score coefficients. The factor scores generated by the regression will be standardized similar to Z-score metric (values range from -3 to 3) with a normal distribution of mean equal to 0, standard deviation equal to 1 and not in the original metric of the original variables. Variables that high positive loadings (or respectively negative) will contribute positively (or negatively) to this factor. Consequently, individuals who score high on these variables incline to have higher (or lower) factor scores on this specific factor (Field, 2009).

Table 4-9 represents standardized scoring coefficients of each variable for each of the factor (Instrumental and Symbolic-Affective). The higher the absolute value of the coefficient, the more crucial the corresponding variable is in estimating the factor. For instance, COMFORT with a standardized scoring coefficient of 0.24983 for Factor 1 seems to have a relative higher influence on Factor 1 compared to the other variables and a relative lower effect on Factor 2 compared to the other variables.

Table 4-9: Scoring coefficients (method=regression) based on Varimax rotated factors

Scoring coefficients (method=regression) based on varimax rotated factors		
Variable	**Factor1**	**Factor2**
FREEDOM	0.02015	0.45434
STATUS	0.01447	0.38517
TASTE	-0.00289	0.38425
PRICE	0.18802	0.00123
COMFORT	0.24983	0.02318
RELAXATION	0.25023	0.02242
TIME	0.22136	-0.01744
SAFETY	0.16851	0.03936
FLEXIBILITY	0.22523	-0.02469

The next step is to mean centering the factors created before running the binary logistic regression. By centering the variables prior to the binary logistic analysis, reduction of multicollinearity and better interpretation of the outcomes can be achieved. The new variables created are: CENTINSTR and CENTSYMBOL.

4.1.5 Reliability

Internal consistency evaluates the reliability of the data meaning how closely linked a set of variables are as a group. Cronbach's alpha will be used to examine this assumption and to test whether the interrelated items have high communalities and low uniqueness. Communalities can be described as the proportion of common variance (variance shared with other variables) existing in a variable. Higher Cronbach's alpha scores demonstrate higher interrelated reliability. Alpha scores of 0.7 or higher are considered as “acceptable” (Netemeyer et al., 2003)

Table4-10: Cronbach' alpha for reliability

Construct	Cronbach’s alpha	N of Items
Instrumental	0.8525	6
Symbolic-Affective	0.7260	3

The reliabilities of people’s perceptions towards the instrumental aspects of public transportation scale (a=0.8525) and people’s perceptions towards the symbolic-affective aspects of public transportation are acceptable and the factors have nearly high internal consistency

4.2 Binary logistic regression

Logistic regression is just an extension of simple linear regression. It is assumed that complicated modal choice behaviors of any group of individuals can be model with logit models. The mathematical core of logit models is relied on the utility theory or theory of utility maximization (Ben-Akiva et al., 1985). There are two types of logit models: Binary Logit model and Multinomial Logit model. The fundamental difference between these two models is based on the number of the alternatives being included to the model. Binary Logit models include only two discrete alternatives while Multinomial Logit models are capable to model a larger number of alternatives. (Khan, 2007). For this thesis, a Binary Logit model will be utilized to answer the main research question.

A binomial logistic regression predicts the possibility that an observation belongs to one of two categories of a binary dependent variable relied on one or more independent variables being either categorical or continuous. A Binary Logit model is applied in this study to comprehend whether individuals make use of the Public Transport (or not) based on instrumental factors or symbolic-affective ones. The dependent variable is “PT utilization”, measured on a binary scale- “use” or “not use” and the independent variables are grouped into two main categories, instrumental factors and symbolic-affective factors, measured on a continuous scale. The binary logistic regression analysis contains chances or “odds”. The term “odds” is in this paper the possibility that an individual utilizes PT as the main mode of transportation divided by the chance that an individual does not use PT as the main mode of transportation. Table 2-11 summarizes the dependent, independent and control variables used in the binary logistic regression.

Table 4-11: Summary statistics for dependent, independent & control variables

Variable	Obs	Mean	Std. Dev.	Min	Max
PT_USERS	1,167	.1079692	.3104745	0	1
CENTINSTR	1,167	0	1	-2.352419	3.170413
CENTSYMBOL	1,167	0	1	-2.616868	2.45626
AGE	1,167	6.169.666	1.593406	3	10
GENDER	1,167	.5972579	.49066	0	1
EMPL_STAT	1,167	1.430163	.8314458	1	4
EDUCATION	1,167	.6743787	.4688074	0	1
URBAN	1,167	2.724936	1.247538	1	5
INCOME	1,167	3.807198	2.084333	1	7

Three model are developed to satisfy the needs of this thesis; ***Model* 1** evaluates the influence of the independent variables on the dependent one without the control variables. ***Model 2*** estimates the effect of both the independent and control variables on the dependent one. Yet, in this model, the control variable "URBAN" is not included. The reason behind this selection is based on the theoretical evidences found on Chapter 2. More specifically, it was reported that people may choose to travel by public transportation influenced by their choice of where to live. So, individuals tend to make choices that are related with travel behavior based on their needs and preferences ("residential self-selection). Finally, in some recent studies about the "residential self-selection" case (for instance, Kitamura et al. 1997; Næss and Jensen, 2004; Næss, 2005) attitudinal variables as well as car ownership, socioeconomic and demographic variables have been included as control variables. This leads to form more precise outcomes about the "residential self-selection" situation without the influence of people's attitudes about public transportation. Consequently, ***Model 3*** estimates not only the effect of the independent variables on the dependent one controlling for age, income, education, status employment, gender and urbanity but also the influence of urbanity on the dependent variable controlling for the attitudinal variables to draw conclusions about the "residential self-selection" phenomenon.

When a binomial logistic regression is used to analyze the available data, it is necessary to validate that these data can indeed be analyzed using a binomial logistic regression. The data need to satisfy some assumptions in order for a binomial logistic regression to provide accurate results. On the one hand, logistic regression does not demand a linear relationship between the dependent and the independent variables, the residuals do not need to be normally distributed and homoscedasticity is not necessary. On the other hand, the dependent variable must be measured on a binary scale. Indeed, the dependent variable being analyzed in this study is a binary variable that provides two possible outcomes: Individuals use PT or individuals do not use PT (and they use another alternative namely car).

Secondly, logistic regression demands each observation to be independent meaning that the measurements for each participant are not affected by or related to the measurements of other participants. This assumption can be violated when, for instance students are clustered together in a hierarchical form or repeated measures have been extracted at several time points. Yet, these two violations are not applied to the present sample, so the assumption of independence among the observations is met. Moreover, the model needs to have little or no multicollinearity meaning that the independent variables must be independent from each other.

Table 4-12: Correlation matrix for binary logistic

	PT_USERS	CINSTR	CSYMB	AGE	GENDER	INCOME	EMPL_STAT	EDUC	URBAN
PT_USERS	1								
CINSTR	0.2019	1							
CSYMB	-0.0187	0.0002	1						
AGE	-0.1463	0.0482	0.0502	1					
GENDER	-0.0240	-0.0659	-0.0836	0.2027	1				
INCOME	-0.1136	-0.0470	0.0058	0.0357	0.0959	1			
EMPL_STAT	0.0525	0.1353	0.0348	-0.0105	-0.2982	-0.0714	1		
EDUC	-0.0116	0.0752	0.0063	0.0821	-0.0300	-0.1170	0.1814	1	
URBAN	-0.1868	-0.1338	0.0139	0.1616	0.1173	-0.0010	-0.0396	0.0374	1

According to Table 4-12, there is no multicollinearity among the variables. Last but not least, the most essential assumption of the analysis is that there must be a linear relationship between the independent variables and the logit transformation of the dependent variable (Garson, 2009). A Box-Tidwell test is performed to examine the null hypothesis about the existence of linear relation between the log odds and the independent variables. The fundamental procedure for Box-Tidwell is to accomplish an initial analysis with the independent variables in the regression equation, then transform all the independent variables via Box-Tidwell, add them into the regression equation simultaneously with the initial variables, and finally make conclusions if any of these transformed variables are significant. (Box & Tidwell, 1962). Consequently, the natural log of "Instrumental" and "Symbolic-Affective" factors are calculated and contained in the analysis as first order interactions. The null hypothesis to be tested is that there is no meaningful curvilinearity in the model. If the outcome of the analysis illustrates a p-value$\leq$0.05 then the relation between the logit and the independent variables is non-linear. Table 2-11 indicates the results of the Box-Tidwell test.

Table 4-13: Box-Tidwell regression model for linearity assumption

Box-Tidwell regression model						
Logistic regression	Number of obs = 1,167					
	LR chi2(8) = 63.88					
	Prob > chi2 =0.0000					
Log likelihood = -367.6938	Pseudo R2 =0.0799					
PT_USERS	Coef.	Std. Err.	z	P>z	[95% conf.Interval]	
IINST__1	-2.429.089	1.404.544	-1.73	0.084	-5.181.944	3.237.657
IINST_p1	1.018.736	6.475.289	1.57	0.116	-2.503.976	2.287.869
ISYMB__1	-5.318.217	4.131.179	-1.29	0.198	-1.341.518	2.778.745
ISYMB_p1	.7329479	1.237.507	0.59	0.554	-1.692.521	3.158.416
IINTE__1	1.517.453	9.173.329	1.65	0.098	-2.804.864	3.315.392
IINTE_p1	-2.568.665	163.437	-1.57	0.116	-5.771.972	6.346.412
IINTEa_1	5.317.411	4.216.456	1.26	0.207	-2.946.692	1.358.151
IINTEap1	-.5401498	.9110121	-0.59	0.553	-2.325.701	1.245.401
_cons	5.499849	.210841	0.76	0.446	-8.633.139	1.963.284
INSTR	-1.760.328	134.615	-1.31	Nonlin. dev. 1.296 (P = 0.255)		
p1	.5907328	2.599.777				
SYMBOL	-1.114.043	.2907328	-3.83	Nonlin. dev. 1.737 (P = 0.187)		
p1	3.156.371	.3135172				
INTER1	-.4673351	.3847134	-1.21	Nonlin. dev. 2.076 (P = 0.150)		
p1	.2072708	2.037.709				
INTER2	-.7238606	.1856937	-3.90	Nonlin. dev. 1.064 (P = 0.302)		
p1	2.270.829	.2268463				
Deviance: 738.237.						

It can be observed that all the interaction variables are insignificant at a significance level of a=0.05. Therefore, it can be concluded that there is a linear relation between the independent variables and the dependent variable.

Chapter 5: Results

In the previous chapter a factor analysis was conducted to identify clusters of correlated variables measuring together an underlying dimension. From the nine independent variables kept after the first steps of the factor analysis, it was proved that five independent variables load to the "Instrumental" factor describing people's opinions towards "objective" aspects of public transportation namely safety, comfort or reliability and three independent variables load to the "Symbolic-Affective" factor expressing individuals' perceptions towards "subjective" characteristics of public transportation such as prestige, social status or pleasure. Those variables, being measured in a continuous scale, are the new independent variables for the binary logistic performed in this chapter. The core focus of this paper is to identify if positive opinions towards those two factors increase the utilization of public transportation (Table 5-1) and which of these two factors has the strongest influence on people's intention to travel by public transportation (Main research question).

Table 5-1: Summarization of hypotheses and null hypotheses

HYPOTHESES	**NULL HYPOTHESES**
H1: Positive perceptions towards the instrumental aspects of public transportation lead to an increase in the use of this mode.	Model 1 H_0: β_1=0
H2: Positive perceptions towards the symbolic-affective aspects of public transportation lead to an increase in the use of this mode.	Model 1 H_0: β_2=0

Centrally in the logistic regression is the estimation of the log odds of an event (the probability of this event to happen). Mathematically, this is expressed as follows (Equation 5.1):

$$\log\left(\frac{p(y=1)}{1-(p=1)}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n \quad (5.1)$$

X_1, X_2, X_3… X_n are the independent variables

β_0 is the coefficient of the constant

$\beta_1, \beta_1, \beta_2 ... \beta_n$ are the coefficients of the n independent variables

$p\ (y_i)$ is the probability of an event that is based on the n-independent variables.

5.1 Model 1

In this part of the thesis, the model is estimated without adding the control variables to analyze the influence of the instrumental and symbolic-affective factors on the dependent variable and to answer the two hypotheses and the main research question.

Goodness-of-fit

In general, a goodness-of-fit test evaluates if the sample data represents the data being expected to find in the real population. The most common of the goodness- of- fit tests is the log likelihood chi-square. It is an omnibus test to observe if the model as a whole is statistically significant (Harrell, 2001).

Table 5-2: Measures of fit for logistic Model 1

MEASURES OF FIT FOR LOGISTIC OF PT_USERS			
Log-Lik Intercept only	-399.404	Log-Lik Full model	-375.158
D(1158):	735.388	LR(2):	48.490
		Prob > LR	0.000
McFadden's R2:	0.061	McFadden's Adj R2	0.053
Maximum Likelihood R2	0.041	Cragg & Uhler's R2	0.082
McKelvey and Zavoina's R2	0.121	Efron's R2	0.041
Variance of y*	3.743	Variance of error	3.290
Count R2	0.892	Adj Count R2	0.000
AIC	0.648	AIC*n	756.317
BIC	-7470.074	BIC'	-34.366

Table 5-2 demonstrates the results of the goodness-of-fit tests. Firstly, the omnibus test statistic assesses the difference between the null model (the model with only the intercept) and the full model (the model with the addition of the independent variables). So, the null hypothesis is that all the coefficients are equal to zero. In this case, with chi-square values= 48.490, the null hypothesis is rejected because the p-value is less than 0.05, meaning that the addition of the independent variables enhance the predictive power of the model.

Additionally, the -2 Log likelihood (goodness of fit test) value for the full model is 735.388 and that of null model is 798.724. A drop of 63.336 states that, after the addition of the independent variables, the predictive power of the model improved. The Cox & Snell R Square (Maximum Likelihood R^2 in the table) is an attempt to offer a logistic regression equal to coefficient determined in multiple regression while the Nagelkerke R Square (Cragg & Uhler's R^2 in the table) adjusts the Cox & Snell R Square to take values from 0 to 1. The values for both Cox & Snell R Square and Nagelkerke R Square are 4.1% and 8.2% respectively indicating a poor fit although, according to Hosmer et al. (2000), these values do not explain the amount of variance constituted by the model the same as the R-square in multiple regression.

Table 5-3: Hosmer and Lemeshow Test Model 1

Hosmer and Lemeshow Test	
Logistic model for PT_USERS goodness-of-fit test	
Number of observations	1167
Number of covariate patterns	950
Pearson chi2(947)	982.94
Prob>chi2	0.2030

Finally, the Hosmer and Lemeshow Test investigates if the predicted probabilities are the same as the observed ones. The model has an overall goodness of fit if the p-values>0.005 (Hosmer et al., 2000). Based on Table 5-3, the model yields a non-significant difference between the observed and predicted probabilities proving a good model fit.

Interpretation of Model 1

Equation 5.1 is adapted to express the probability that an individual uses public transportation based on the instrumental and symbolic-affective factors without the addition of the control variables (Equation 5.2).

$$\log\left(\frac{p(PT\_USERS=1)}{1-(p=1)}\right) = \beta_0 + \beta_1 CINSTR + \beta_2 CSYMBOL \quad (5.2)$$

Table 5-4: Logistic regression Model 1

LOGISTIC REGRESSION		Number of obs	1,167			
		LR(2):	48.49			
		Prob > LR	0.000			
		Pseudo R2	0.0607			
Log likelihood = -367.6938						
PT_USERS	Odds Ratio	Std.Err.	z	P>|z|	[95% Conf. Interval]	
CINSTR	1.957468	.1966582	6.69	0.000	1.6076	2.383478
CSYMBOL	.9567176	.0930908	-0.45	0.649	.7906057	1.157731
_cons	.1022882	.0110337	-21.14	0.000	.0827957	.1263698

From Table 5-4, it can be stated about the sign and the significance of the coefficients but not about the magnitude of the effect of the independent variables on the dependent one. In general, instrumental factors have a positive and significant effect at the 5% significance on the intention of individuals to utilize public transportation. On the other hand, symbolic-affective factors have an insignificant effect at the 5% significance on people's intention to travel by public transportation. This outcome seems to be plausible based on the theoretical evidences provided in Chapter 2. Symbolic-affective factors are highly connected with the car rather than public transportation. It is possible that those individuals who have the necessity to utilize this mode of transportation that gives them higher social status or prestige compared to their peers or pleasure whilst driving use the car rather than public transportation. The latter is perceived more as a symbol of inferiority or less luxurious lifestyle. Consequently, people have not related public transportation with its symbolic-affective aspects and that is why this factor has insignificant influence on the utilization of public transportation.

Finally, one can comment on the intercept having a negative value at the 5% significance level of .1022882. This is related with the expected mean value of the dependent variable as the independent ones are mean-centered. So, this value represents the predicted probability of a respondent using public transportation as the dominant mode of transport when both instrumental and symbolic-factor factors are mean-centered.

To assess the magnitude of the effects of the independent variables on the dependent one, the "average marginal effects" method is applied. This method gives the marginal effects on average for this dataset.

Table 5-5: Average Marginal Effects for Model 1

Average marginal effects				Number of obs	1,167	
Model VCE: OIM						
Expression Pr(PT_USERS) predict()						
dy/dx w.r.t. : CINSTR CSYMBOL						
	Delta-method					
	dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]	
INSTR	.0616577	.0093538	6.59	0.000	.0433247	.0799908
SYMBOL	-.0040619	.0089312	-0.45	0.649	-.0215668	.013443

According to Table 5-5, on average in this dataset, having positive attitudes towards the different instrumental attributes of public transportation increases the probability of using public transportation by 6.2 percentage points, ceteris paribus. This effect is significant at the 5% significance level.

5.2 Model 2

The model is estimated including now the control variables namely age, annual income, gender, employment status of the participant and level of education (Equation 5.3). The main goal of this re-estimation is to identify possible changes on the predictive power of the model and the effect of the control variables on the dependent variable without the "residential self-selection" effect.

$$\log\left(\frac{p(PT\_USERS=1)}{1-(p=1)}\right) = \beta_0 + \beta_1 CINSTR + \beta_2 CSYMBOL + \beta_3 \text{AGE} + +\beta_4 \text{GENDER} + \beta_5 \text{INCOME} + \beta_6 \text{EMPL\_STAT} + \beta_7 EDUCATION \quad (5.3)$$

Goodness-of-fit

Table 5-6: Measures of fit for logistic Model 2

MEASURES OF FIT FOR LOGISTIC OF PT_USERS			
Log-Lik Intercept only	-399.404	Log-Lik Full model	-349.805
D(1151):	699.610	LR(11):	99.197
		Prob > LR	0.000
McFadden's R2:	0.124	McFadden's Adj R2	0.084
Maximum Likelihood R2	0.053	Cragg & Uhler's R2	0.164
McKelvey and Zavoina's R2	0.197	Efron's R2	0.099
Variance of y*	4.098	Variance of error	3.290
Count R2	0.888	Adj Count R2	-0.040
AIC	0.627	AIC*n	731.610
BIC	-7428.973	BIC'	-21.513

Table 5-6 defines the results of the Measures of fit for Model 2. Based on the omnibus test statistic, the chi-square values=99.197 and the null hypothesis (all the coefficients are equal to zero) is rejected because the p-value is less than 0.05, meaning that the addition of the control variables improves the predictive power of the model. Akaike's Information Criterion (AIC) evaluates the relative value of a statistical model and can be used to compare different models in terms of goodness of fit. A model with the lowest AIC value is the most preferable one. Model 1 has an AIC value of 0.648 while Model 2 has an AIC value of 0.627 meaning that Model 2 is better model than Model 1 in terms of goodness of fit.

Interpretation of Model 2

Table 5-7 shows the results of the binary logistic regression for Model 2. The main independent variables have the same "behavior" as in Model 1 in terms of statistical significance and sign. AGE has an insignificant effect at the 5% significance on the dependent variable.

Table 5-7: Logistic regression Model 2

Logistic regression			Number of obs	1,167	
			LR chi(11):	99.20	
			Prob > LR	0.000	
			Pseudo R2	0.1242	
Log likelihood= -349.80492					
PT_USERS	Odds Ratio	Std.Err.	z	P>|z|	[95% Conf. Interval]	
CINSTR	1.951195	.2055154	6.35	0.000	1.58725	2.39859
CSYMBOL	.9979994	.0995405	-0.02	0.984	.8207887	1.21347
AGE	.8656344	.0678404	-1.84	0.066	.7423783	1.009355
INCOME						
Average income	.672609	.193107	-2.08	0.034	.3831612	1.180711
High income	.4862867	.1713066	-2.05	0.041	.243801	.9699498
Unknown	.4130075	.1457119	-2.51	0.012	.2068465	.8246461
GENDER						
Male	1.11	.2512455	0.46	0.645	.7122885	1.729777
EDUCATION						
Low education	.8032832	.1757072	-1.00	0.317	.5232147	1.233268
EMPL_STAT						
Unemployed	.7963399	.266258	-0.68	0.496	.4135207	1.533556
Student	3.040611	1.188875	2.84	0.004	1.412999	6.543042
Other	.3903683	.2470903	-1.49	0.137	.1128995	1.349762
_cons	.3913329	.1830361	-2.01	0.045	.1564654	.9787557

GENDER: Being a male has a positive effect on people's intention to utilize public transportation. Yet, being a male is not significantly different at the 5% significant level from being a woman in terms of public transportation utilization, ceteris paribus.

EDUCATION: Low-educated participants have an insignificant effect at the 5% significant level on the dependent variable meaning that being a low-educated person is not significantly different at the 5% significant level from being a high-educated person in terms of public transportation utilization, ceteris paribus.

EMPL_STAT: Being unemployed has an insignificant effect at the 5% significant level on the dependent variable meaning that being unemployed is not significantly different at the 5% significant level from someone having a job in terms of public transportation utilization, ceteris paribus. Yet, people being students have a positive and significant effect at the 5% significant level on the dependent variable compared to someone who is employed, ceteris paribus. This is plausible based on the fact that students in the Netherlands can travel for free with public transportation (with the "OV-chipkaart") increasing their intention to utilize this mode of transportation. Another explanation is that students usually do not possess cars because of restricted budget.

INCOME: Earning the average income in the Netherlands has a negative and significant effect at the 5% significant level on the dependent variable compared to a low-income employee, ceteris paribus. A high-income employee has a negative and significant effect at the 5% significant level on the dependent variable compared to a low-income employee, ceteris paribus. As a result, the more people earn in an annual base, the less they travel by public transportation.

5.3 Model 3

The model is estimated including now all the control variables namely age, annual income, gender, employment status of the participant, level of education and urbanization (Equation 5.4). The main goal of this re-estimation is to identify possible changes on the predictive power of the model and the effect of the control variables on the dependent variable with the "residential self-selection" effect.

$$\log\left(\frac{p(PT\_USERS=1)}{1-(p=1)}\right) = \beta_0 + \beta_1 CINSTR + \beta_2 CSYMBOL\ + \beta_3\text{AGE}\ + +\beta_4\text{GENDER}\ + \beta_5\text{I}NCOME + \beta_6 EMPL\_STAT + \beta_7 EDUCATION + \beta_8 URBAN \quad (5.4)$$

Goodness-of-fit

Table 5-8: Measures of fit for logistic Model 3

MEASURES OF FIT FOR LOGISTIC OF PT_USERS			
Log-Lik Intercept only	-399.404	Log-Lik Full model	-337.831
D(1146):	673.164	LR(13):	123.14
		Prob > LR	0.000
McFadden's R2:	0.154	McFadden's Adj R2	0.105
Maximum Likelihood R2	0.102	Cragg & Uhler's R2	0.206
McKelvey and Zavoina's R2	0.259	Efron's R2	0.116
Variance of y*	4.440	Variance of error	3.290
Count R2	0.889	Adj Count R2	-0.024
AIC	0.612	AIC*n	715.164
BIC	-7420.108	BIC'	-19.710

Table 5-8 depicts the results of the Measures of fit for Model3. Based on the omnibus test statistic, the chi-square values=123.14 and the null hypothesis (all the coefficients are equal to zero) is rejected because the p-value is less than 0.05, meaning that the addition of the control variables improves the predictive power of the model. Model 3 has an AIC value of 0.612 meaning that is the best model in terms of goodness of fit since it has the lowest AIC value compared to the previous models.

Interpretation of Model 3

Table 5-9 demonstrates the results of the binary logistic regression for Model 3. The results remain almost the same as in Model 2. Surprisingly, INCOME is now insignificant at the 5% significant level assuming that the addition of variable URBAN costs precision, lower t-statistics and higher p-values.

Table 5-9: Logistic regression Model 3

LOGISTIC REGRESSION		Number of obs	1,167			
		LR chi (13):	123.14			
		Prob > LR	0.000			
		Pseudo R2	0.1542			
Log likelihood= -337.83148						
PT_USERS	Odds Ratio	Std.Err.	z	P>|z|	[95% Conf. Interval]	
CINSTR	1.844067	.198045	5.66	0.000	1.494037	2.276104
CSYMBOL	.9962422	.1001576	-0.00	0.999	.8180673	1.213224
AGE	.912912	.072758	-1.03	0.303	.7808888	1.067256
INCOME						
Average income	.7193522	.2104917	-1.03	0.302	.4053863	1.27648
High income	.5183101	.1854827	-1.76	0.078	.2570268	1.045204
Unknown	.414767	.1485247	-2.51	0.012	.2055871	.8367823
GENDER						
Male	1.167912	.2664401	0.67	0.503	.7468312	1.826409
EDUCATION						
Low education	.8354613	.1858045	-0.81	0.419	.540283	1.291908
EMPL_STAT						
Unemployed	.7182322	.2440211	-0.95	0.340	.3690347	1.397856
Student	2.786112	1.101779	2.62	0.009	1.283475	6.04797
Other	.4215009	.2709503	-1.45	0.148	.1195713	1.485833
URBAN						
Highly urbanized	3.206369	1.129968	3.31	0.001	1.607084	6.397177
Low urbanized	1.100545	.4558348	0.23	0.817	.4887066	2.478375
_cons	.124869	.0729592	-3.56	0.000	.0397291	.3924642

For the control variable URBAN, the reference category is "Moderately urbanized areas": Living in a highly urbanized area has a positive and significant effect at the 5% significant level on the dependent variable compared with someone living in a moderately urbanized area, ceteris paribus. This result seems to be plausible since people inhabiting in urban areas have to deal with the congestion and lack of parking spots in a daily base. Consequently, their intention to travel by public transportation raises as urbanization increases. Regarding the “residential self-selection” topic, it was discussed that in urban areas in the Netherlands public transportation system is well developed and access to transit is easier than in rural areas. The access to transit is one of the most significant factors urging people to choose to live near public transportation stations increasing their intention to use it. So, controlling for people’s preferences towards the different instrumental and symbolic-affective aspects of public transportation, living near public transportation stations can increase more the utilization of public transportation in urban areas than in rural ones.

On the other hand, living in rural areas has an insignificant effect at the 5% significant level on the dependent variable meaning that living in rural areas is not significantly different at the 5% significant level from living in moderately urbanized areas in terms of public transportation utilization, ceteris paribus.

Table 5-10: F-Test for URBAN

(1)	[PT_USERS]1.URBAN=0	
(2)	[PT_USERS]3.URBAN=0	
	chi2(2)	21.52
	Prob>chi2	0.0000

Table 5-10 shows that the probability is nearing zero which means the null hypothesis that URBAN_1, URBAN_3 are zero at the 5% significant level is rejected. Urbanity therefore has a significant effect on people’s intention to use public transportation.

To assess the magnitude of the effects of urbanity on the dependent one controlling for the attitudinal variables, the “average marginal effects” method is implemented.

Table 5-11: Average Marginal Effects for urbanity

AVERAGE MARGINAL EFFECTS				Number of obs	1,167	
Model VCE: OIM						
Expression Pr(PT_USERS) predict()						
dy/dx w.r.t. : 1.URBAN 3.URBAN						
	Delta-method					
	dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]	
URBAN						
Highly urbanized	.0907704	.02156	4.21	0.000	.0485135	.1330272
Low urbanized	.0048865	.0209474	0.23	0.816	-.0361695	.0459426
Note: dy/dx for factor levels is the discrete change from the base level.						

Based on Table 5-11, on average in this dataset, living in highly urbanized cities increases the probability of using public transportation by 9.1 percentage points compared to someone who live in a moderately urbanized area, ceteris paribus. This effect is significant at the 5% significance level.

Table 5-12 compares the odds ratio of the independent and control variables among the three models. First of all, it is observed that the odds ratio for the Instrumental factor decrease slightly from 1.96 to 1.95 when age, income, education, gender and employment status are controlled meaning that people's perceptions about the instrumental aspects of public transportation and the control variables are correlated. In Model 3, the odds ratio for the Instrumental factor is even lower than in the previous models meaning that there is correlation between urbanity and this factor. Moreover, regarding individuals' attitudes about the symbolic-affective aspects of public transportation, the odds ratio for this variable increase by 0.4 in Model 2 compared to Model 1 showing that the control variables and this factor are not correlated. Yet, in Model 3, the odds ratio for the Symbolic-Affective factor reduce insignificantly meaning that urbanity is correlated with this factor.

Table 5-12: Comparison of the three models

	Model 1	Model 2	Model 3
CINSTR	1.957468	1.951195	1.844067
CSYMBOL	.9567176	.9979994	.9962422
AGE		.8656344	.912912
INCOME			
Average income		.672609	.7193522
High income		.4862867	.5183101
Unknown		.4130075	.414767
GENDER			
Male		.8032832	1.167912
EDUCATION			
Low education		1.11	.8354613
EMPL_STAT			
Unemployed		.7963399	.7182322
Student		3.040611	2.786112
Other		.3903683	.4215009
URBAN			
Highly urbanized			3.206369
Low urbanized			1.100545

It is concluded that, based on the ***Hypothesis 1***, instrumental aspects affect people's intention to travel by public transportation since this factor is significant at the 5% significant level, ceteris paribus. More specifically, positive attitudes towards the instrumental aspects of public transportation lead to an increase of 6.2 percentage points in the use of this mode. So, if individuals perceive public transportation as safe, comfortable, cheap and reliable, they will use it more often than the alternative one (namely car).

Regarding ***Hypothesis 2***, the results of the binary logistics regression proved that symbolic-affective aspects do not have any influence on participants' intention to utilize public transportation since this factor is insignificant at the 5% significant level, ceteris paribus. As it was defined, a plausible explanation for this phenomenon is that symbolic-affective factors are strongly related with the car rather than public transportation. So, people seem to be indifferent towards the symbolic-affective aspects of public transportation and their travel behavior is not affected by those factors.

The **main research question** of this thesis is "*Do people use public transportation based more on instrumental factors such as convenience, speed and cost, or more on affective-symbolic factors such as status, freedom and excitement?"* Obviously, individuals utilize public transportation based more on its instrumental aspects rather than its symbolic-affective ones. Positive opinions towards the different instrumental aspects of public transportation increase its utilization while symbolic-affective factors seem to be more strongly connected with the car and their effect on individuals' intention to travel by public transportation is negligible.

Conclusion

Positive attitudes towards the different instrumental aspects of public transportation increase the use of this mode of transportation by 6.2 percentage points, ceteris paribus while people seem to be indifferent towards the symbolic-affective aspects of public transportation and their intentions to travel with this transportation mode are not influenced by this factor. Regarding the control variables, people being students have a positive and significant effect at the 5% significant level, ceteris paribus, due to the fact that they can travel for free with public transportation in the Netherlands and also may not possess cars because of limited budget increasing their intention to utilize this mode of transportation. INCOME has a negative and significant effect at the 5% significant level on the dependent variable meaning that the more people earn in an annual base, the less they travel by public transportation.

Additionally, living in highly urbanized areas has a positive and significant effect at the 5% significant level on the dependent variable, controlling for the attitudinal variables. This can have a twofold explanation; on the one hand, highly urbanized areas have higher issues with the traffic jam and parking spots leading people to utilize more public transportation than the car. On the other hand, highly urbanized cities have better access to the transit urging individuals to live near public transportation stations and increasing their preferences towards this mode of transportation (residential self-selection). Last but not least, Model 3 is the best model compared to Model 1&2 in terms of goodness of fit proving that the addition of urbanization as a control variable explains better the predictive power of the model.

5.4 Limitations

The biggest limitation in this paper is the survey itself. First of all, this survey was constructed to examine a variety of topics regarding the travel behavior of individuals and households dynamically over time as well as how changes in travel behavior, personal and household attributes and other elements influence mobility. It is not specified on the needs of this thesis and that is why it was difficult to isolate the variables being necessary to answer the main research question. Due to a limited number of variables describing individuals' attitudes towards the different instrumental and symbolic-affective aspects of public transportation, several arbitrary assumptions were formed. For instance, there are only two variables (PLEASURE and PRESTIGE) defining directly participants' opinions towards the symbolic-affective attributes of public transportation. The rest of the variables being utilized in the factor analysis to constitute this factor are people's opinions towards the car. As a consequence, it is possible that the results of both the factor analysis and the binary logistic regressions are less precise and realistic than they would be if the proper variables had been used.

Moreover, in the part of the factor analysis, the independent variables PLEASURE and PRESTIGE theoretically loaded to the "wrong" factor (instrumental factor instead of symbolic-affective one). This fact is connected with the above-mentioned limitations of the survey. Because of the absence of link between the questions and the research aims and objectives of this paper, the participants could not distinguish easily the differences between the instrumental and symbolic-affective factors to respond accordingly. As a result, those two variables together with valuable information were omitted from the further analysis making the influence of the symbolic-affective factor on the dependent variable weaker.

Chapter 6: Conclusion

This thesis aims to investigate people's opinions towards different aspects of public transportation so as to comprehend which factors affect their intention to utilize this mode of transportation. The main factors which this paper has been focused on are the instrumental and symbolic-affective ones by controlling for the more "traditional" factors being examined in previous studies such as socio-demographic characteristics, built environment and land use and trip characteristics. As it was discussed in Chapter 2, according to Daziano et al (2015), instrumental factors are the more objective attributes characterizing public transportation, for instance safety, comfort, reliability and price. On the other hand, symbolic-affective factors are the more subjective aspects of public transportation namely status, image, arousal, autonomy and privacy (Steg, 2005). Consequently, the following research question was set up:

Do people use public transportation based more on instrumental factors such as convenience, speed and cost, or more on affective-symbolic factors such as status, freedom and excitement?

To answer this question a grounded theory approach in combination with factor and binary logistic regression analysis was applied. The data were extracted from The Netherlands Mobility Panel (MPN) which is a longitudinal research that links the travel behavior of individuals and households dynamically over time as well as how changes in travel behavior, personal and household attributes and other elements influence mobility. Most of the participants are educated, middle-aged men earning a significant amount of money in an annual base meaning that it is less possible to utilize public transportation as it was verified in Chapter 3 (only 10% of the sample travel by public transportation frequently). Then, a factor analysis was implemented to decrease the eleven independent variables into fewer number of factors. Factor 1 includes comfort, relaxation, save of time, safety, flexibility and price and it was named as "Instrumental" factor. Factor 2 includes personal taste/sense of style, status and freedom and it was named as "Symbolic-Affective" factor.

Chapter 4 demonstrates the results of the binary logistic regression analysis. Initially, 3 models were formed. ***Model 1*** evaluated the influence of the independent variables on the dependent one without the control variables. The results of this model proved that positive attitudes towards the instrumental aspects of public transportation lead to an increase of 6.2 percentage points in the use of this mode. Yet, symbolic-affective aspects of public transportation has an insignificant effect at the 5% significant level, ceteris paribus. Consequently, people seem to be indifferent towards the symbolic-affective aspects of public transportation and their travel behavior is not affected by those factors. In ***Model 2***, both the independent and control variables were included in the model. Yet, urbanization was not included to measure the influence of the control variables without the "residential self-selection" effect. The results showed that being a student has a positive and significant effect at the 5% significant level, ceteris paribus, due to the fact that they can travel for free with public transportation in the Netherlands and also may not possess cars because of limited budget increasing their intention to utilize this mode of transportation. Also people earning a high income have a negative and significant effect at the 5% significant level on the dependent variable meaning that the more people earn in an annual base, the less they travel by public transportation.

Last but not least, ***Model 3*** estimated not only the effect of the independent variables on the dependent one controlling for age, income, education, status employment, gender and urbanity but also the influence of urbanity on the dependent variable controlling for the attitudinal variables to draw conclusions about the "residential self-selection" phenomenon.". Living in highly urbanized areas has a positive and significant effect at the 5% significant level on the dependent variable, controlling for the attitudinal variables. This can be explained by the fact that either highly urbanized areas have higher issues with the traffic jam and parking spots leading people to utilize more public transportation than the car or better access to the transit urging individuals to live near public transportation stations and increasing its utilization (residential self-selection). Controlling for individuals' attitudes regarding different aspects of public transportation, it was proved that living in highly urbanized cities increases the probability of using public transportation by 9.1 percentage points compared to someone who live in a moderately urbanized area, ceteris paribus. This effect is significant at the 5% significance level.

Paying attention only on the socio-demographic characteristics of the population or on the built environment of the country is affective up to a certain level. However, the last decades more and more studies have been focused on the attitudinal aspect of travel behavior because in order to change travel behavior, you must understand people. Consequently, which actions can the policy makers take to increase the utilization of public transportation as the preferred mode of transport? It was proved that positive attitudes towards the different instrumental attributes of public transportation can increase their intention to utilize this mode of transportation. But does this factor be so strong to change their travel behavior? Can people change their travel behavior if they still conceive the car as a symbol of status and superiority? Are there any other factors except attitudes which can influence individuals' travel behavior? All these key points are discussed in the next section of this thesis.

Chapter 7: Further recommendations

It is essential to form policies that can decrease car dependency by ameliorating public transport service and promoting a shift to slower modes of transportation for instance walking or cycling. Policies aiming at raising public transport utilization should retain its image, but at the same time, public transport system should become more competitive and attractive. As suggested by this thesis, a good understanding of travel behavior and individuals' expectations and needs are compulsory to enhance service quality. Consequently, it is necessary to detect the possible strengths and weaknesses of public transportation so as to satisfy the customers and increase its market share. Yet, human behavior is complex and multidimensional and that is why developing appropriate and effective measures to evaluate the service quality of public transport system is demanding. An efficacious solution is to comprehend how passengers assess the quality of service and adapt the service to the attributes to satisfy their needs and affect a modal shift (Anable, 2005).

Information availability about the public transportation services is very crucial since it allows passengers to plan and make their journey easier, thus making the experience with public transportation more comfortable. This can be achieved by, for example, introducing real-time information displays near bus or tram stops. Moreover, mobile applications can be very useful since they can be personalized according to the travel needs of each passenger. Finally, transport companies should be adapted to the different abilities and habits of their customers. Modern services, such as providing a guide book or the website in different languages, can promote better image for the company, make people have a more positive attitude towards public transportation and eventually, make public transportation a more attractive means of transport (Ibraeva et al., 2014).

Public transportation is a more sustainable mode of transport, and therefore transport policy should promote it. Advertising campaigns aiming at increasing public transportation use should focus on how to promote the environmental benefits of travelling by public transport by transforming it into an environmental symbol, and thus offsetting the car as a symbol of status (Golob et al., 1998). Additionally, according to Fujii et al. (2003), people should have experiences with public transportation such as a one-month free ticket which can influence them to alter habits, attitudes and travel mode choice. They reported that individuals continued using public transportation even after the period of free ticket finished. These kind of marketing techniques can be proved very efficient so as to promote a more persistent use of public transportation.

But what about the symbolic-affective factors influencing people to use more the cars rather than public transportation? This paper showed that people are indifferent towards the symbolic-affective aspects of public transportation and this factor is not significant enough to alter their travel behavior towards a more sustainable travel mode. However, policy makers seem to ignore the symbolic-affective factors paying more attention on the instrumental ones (Steg, 2005). One solution to achieve changes in travel behavior is: “De-marketing” the car. Current strategies of de-marketing the car try to illustrate the negative aspects of using it, for instance the price of maintenance or to decrease the power of affective connotations created by advertisements and discourage individuals from purchasing a car or utilizing it on a daily basis. It is important to make people realize that they should use the cars in exceptional situations when needed and not for all kind of trips.

Figure 7-1: Poster in the area of Greater Manchester (Ibraeva et al., 2014)

Figure 7-1 is an indicative example of de-marketing the car since it links the utilization of car with traffic jams and obesity (Ibraeva et al., 2014)

But are positive or negative attitudes the only factor influencing travel choice? Affecting attitudes can be proved a powerful tool to persuade people to change their travel mode. Yet, a positive image of the mode is not enough since individuals may not choose that specific mode even if they have a positive attitude towards it. (Loncar-Lucassi, 1998). Consequently, in this part of the thesis other factors having a strong influential power on travel choice than attitudes are examined.

Habits

Individuals make reasonable choices, weighting the pros and cons of different behavioral alternatives. However, people in their everyday life perform many repetitive patterns of behavior since they cannot take into consideration the advantages and disadvantages of all the choices they face during a day because they do not have the time and cognitive capacity for this. They just tend to repeat the same behavior when they face similar cases (Van Wee et al, 2013).

Habit can be defined as an automatic behavior obtained by recurrence and positive motivation (Schwanen et al. 2012). For instance, an individual drives every day to his work using the car. This repetition is becoming gradually a habit and meanwhile gaining the positive motivation of comfort whilst driving the car. Consequently, one of the major challenges for the policy makers is to eliminate this habit to alter travel behavior.

Researchers have been investigating ways of breaking the car usage habits by, for instance, decreasing the price of bus fares or modifying the infrastructural conditions. Some of these interventions have brought the desired results, namely a modal shift, but scientists are still reluctant for the long-term effects (Schwanen et al. 2012).

Cognitive dissonance

Campaigns have attempted to provide information about the negative consequences of using car extensively as the basic mean of transportation and to promote more sustainable travel modes, for instance public transportation. However, it has been observed that these campaigns do not bring long-lasting changes on commuters' behavior (Hornik et al., 1995). Based on this observation, Tertoolen et al. (1998) reported the presence of cognitive dissonance namely a discrepancy between attitudes and behavior. This means that individuals' attitude is oriented towards, for example, a more environmentally friendly way of living but their actual behavior diverts from the intended one.

Generally, cognitive dissonance is an unpleasant feeling and people are trying to reduce it by adapting the behavior (drive less by car) or the cognition ("Traveling by car does not have a negative effect on the environment). For example, commuters may choose to travel less by car (behavioral change) or alter their attitudes (less negative attitudes) towards the undesirable consequences of car utilization (Tertoolen et al., 1998). To overcome the barrier of cognitive dissonance, soft measures can play a key role by increasing car users' awareness of the environmental effects of their travel behavior

Direction of causality

Do attitudes cause travel behavior or vice versa? This is a very important but still ambiguous subject in social psychology. According to Festinger (1957), people incline to decrease any dissonance between their behavior and their attitudes by adapting their attitudes or by adapting their behavior. It is stated that the influence of attitudes on behavior is often stronger than the influence of behavior on attitudes, although there is a part of the scientific community arguing that behavior has also an effect on attitudes (Eagly et al., 1993).

For the transportation planners, it is crucial to realize that changes in people's attitudes will not automatically results in changes in their behavior. If policy makers do not act on dissonance regarding public transportations (for instance by triggering more people to use public transportation through lower fares and ameliorated services), individuals will keep adapting their attitudes towards this travel mode downwards. Thus, it is recommended a regular utilization of this mode of transportation to make people maintain a positive attitude towards this mode (Kroesen et al., 2017).

Self-interest motives: The social dilemma

The decision to use car or public transportation does not have an impact only on an individual level, but also on the prosperity of the others. The choice of travelling by car may have negative consequences on the other people since it causes environmental pollution and congestion. Yet, on an individual level, travelling by car may have a positive effect since commuters enjoy the comfort, flexibility and travel time saving. This conflict between the individual and collective interests can be described as social dilemma. Figure 7-2 highlights the social dilemma and how important is to change people's behavior. As far as mobility is concerned, individuals tend to expose a more selfish attitude if they must alter their behavior to benefit their peers' one.

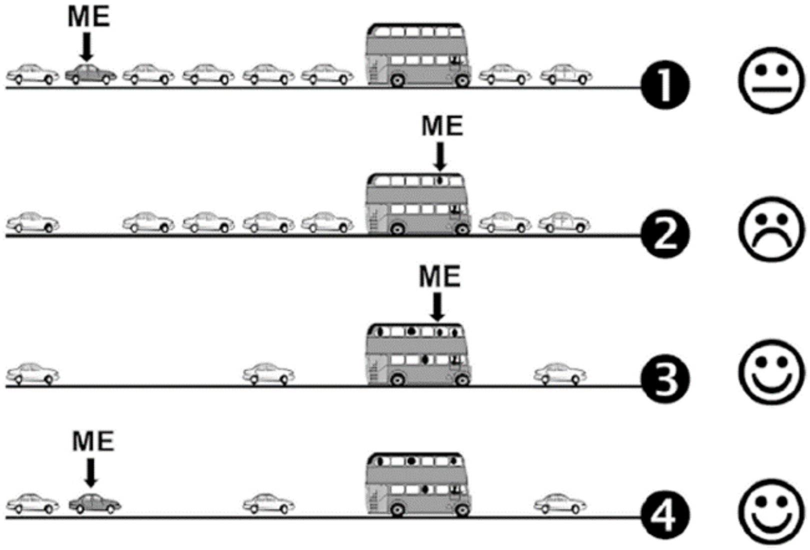

Figure 7-2: Social dilemma of commuting to an urban center. (Lyons, 2011)

According to this example, travelers have two options to move within an urban center: either by car or public transportation. If both travel modes are on the same road, most of the travelers will face the problem of the congestion (situation 1). This problem is not perceived as positive, but at least people will feel comfortable and secure inside their car. In situation 2, if commuters decide to use public transportation, one car will be removed from the road and thus congestion will be decreased slightly. At the same time, the journey will be improved for the rest of the travelers but, in the end, this will result in a negative cost for the individual since he remains at the queue and has lost his comfort and secure.

The only case (situation 3) being beneficial for all the people is when all or the majority of them use public transportation. Finally, the rational car driver would keep using his private vehicle when realizing that there is not traffic jam (situation 4). The car drivers believe that they still gain if they do not change their travel mode compared to those that they have changed. Due to this rational way of thinking, all the travelers deal with congestion and become disappointed. (Lyons 2011).

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Appendix 1: Descriptive statistics

Appendix 1 Table 1: Frequency Distribution table for IVs

Variables	Values	Freq.	Percent	Cum.
Dependent				
PT_USERS	0	1,043	89.22	89.22
	1	126	10.78	100.00
Independent				
COMFORT	1	119	10.19	10.19
	2	378	32.36	42.55
	3	418	35.79	78.34
	4	229	19.61	97.95
	5	24	2.05	100.00
RELAXATION	1	123	10.53	10.53
	2	376	32.19	47.72
	3	423	36.22	78.94
	4	217	18.58	97.52
	5	29	2.48	100.00
TIME	1	208	17.81	17.81
	2	474	40.58	58.39
	3	331	28.34	86.73
	4	140	11.99	98.72
	5	15	1.28	100.00
SAFETY	1	43	3.68	3.68
	2	99	8.48	12.16
	3	399	34.16	46.32
	4	554	47.43	93.75
	5	73	6.25	100.00
FLEXIBILITY	1	163	13.96	13.96
	2	434	37.16	51.11
	3	376	32.19	83.30
	4	177	15.15	98.46
	5	18	1.54	100.00

PLEASURE	1	117	10.02	10.02
	2	369	31.59	41.61
	3	469	40.15	81.76
	4	191	16.35	98.12
	5	22	1.88	100.00
PRESTIGE	1	346	29.62	29.62
	2	452	38.70	68.32
	3	329	28.17	96.49
	4	35	3.00	99.49
	5	6	0.51	100.00
TASTE	1	243	20.80	20.80
	2	375	32.11	52.91
	3	372	31.85	84.76
	4	153	13.10	97.86
	5	25	2.14	100.00
STATUS	1	46	3.94	3.94
	2	380	32.53	36.47
	3	426	36.47	72.95
	4	211	18.07	91.01
	5	105	8.99	100.00
FREEDOM	1	13	1.11	1.11
	2	243	20.80	21.92
	3	371	31.76	53.68
	4	338	28.94	82.62
	5	203	17.38	100.00
PRICE	1	34	2.91	2.91
	2	336	28.77	31.68
	3	409	35.02	66.70
	4	242	20.72	87.41
	5	147	12.59	100.00