Estimating the Willingness to Pay for Improving Road Safety in the Turkish Republic of Northern Cyprus

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ABSTRACT

The incidence of fatalities over the period 2010 to 2014 from automobile accidents in North Cyprus is 2.75 times greater than the average for the EU. With the prospect of North Cyprus entering the EU, many investments will need to be undertaken to improve road safety in order to reach EU benchmarks. The objective of this study is to provide local estimates of the value of a statistical life and injury along with the value of time savings. These are among the parameter values needed for the evaluation of the change in the expected incidence of automotive accidents and time savings brought about by such projects.

In this study we conducted a stated choice experiment to identify the preferences and tradeoffs of automobile drivers in North Cyprus for improved travel times, travel costs, and safety. The choice of route was examined using mixed logit models to obtain the marginal utilities associated with each attribute of the routes that consumers choose. These estimates were used to assess the individuals' willingness to pay (WTP) to avoid fatalities and injuries and to save travel time. We then used the results to obtain community-wide estimates of the value of a statistical life (VSL) saved, the value of injury (VI) prevented, and the value per hour of travel time saved. The estimates for the VSL range from €315,293 to €1,117,856 and the estimates of VI from € 5,603 to € 28,186. These values are consistent, after adjusting for differences in incomes, with the median results of similar studies done for EU countries.

Keywords: Willingness to pay; choice experiment; value of risk reduction; road safety; car drivers.

ÖZ

Kuzey Kıbrıs'ta yaşanılan otomobil kazalarından kaynaklı ölüm vakaları 2010 ve 2014 yılları arasında değerlendirildiğinde Avrupa Birliği (AB) ortalamasının 2.75 katı büyüklüğünde gerçekleşmiştir. Kuzey Kıbrıs'ın Avrupa Birliği'ne girme yolunda, AB kriterlerine ulaşıp yol güvenliğini artırması için bir çok yatırım yapması gerekmektedir. Bu çalışmanın amacı, zaman tasarrufu değeriyle birlikte istatistiksel yaşam ve yaralanma değerlerinin yerel tahminlerinin temin edilmesidir. Bunlar, bu tür projelerin getirdiği, beklenen otomotiv kaza vakaları ve zaman tasarrufu değişiminin değerlendirilmesi için gerekli parametre değerleri arasında olmasıdır.

Bu çalısmada, belirlenmiş tercih yapma deneyi ile, Kuzey Kıbrıs'taki araba sürücülerinin geliştirilmiş seyehat süreleri, maliyetleri ve güvenliği arasındaki denge ile yapmış oldukları tercihler ele alınmıştır. Yöntem seçimi , tüketicilerin tercih yollarının her öznitelik ile ilişkili marjinal yarar elde etmek için karışık logit modelleri kullanılarak incelenmiştir. Bu tahminler ölümleri ve yaralanmaları önlemek ve seyahat süresinden kazanmak için bireylerin göstermiş olduğu ödeme eğilimlerini değerlendirmek için kullanılmıştır. Daha sonra, toplum genelinde sonuçlar elde etmek için istatistiki hayat değerlerini (VSL), yaralanma değerlerini (VI) ve seyahat süreleri değerleri gözlemlenmiştir. Sonuçlara bakıldığında VSL değerleri €315,293 ile €1,117,856 aralığında iken VI değerleri ise € 5,603 ile € 28,186 aralığındadır. Sonuçlara bakıldığında bu değerler, gelir farklılıklarına göre, AB için yapılan benzer çalışmaların sonuçları ile tutarlılık göstermektedir.

Anahtar Kelimeler: Ödeme eğilimleri, tercih deneyi, istatistiksel yaşam değeri, yaralanma değeri, yol güvenliği, otomobil sürücüleri.

This study is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task could be accomplished if it is done one step at a time.

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LIST OF ABBREVIATIONS

AAVKM	Average Annual Vehicle Kilometers
CBA	Cost-Benefit Analysis
CBS	Choice-Based Sampling
CE	Choice Experiment
CEA	Cost-Effectiveness Analysis
CV	Compensating Variation
CVM	Contingent Valuation Method
ESRS	Exogenously Stratified Random Sample
EU	European Union
EVI	Extreme Value type I
GDP	Gross Domestic Product
GNI	Capita Gross National Income
IIA	Independence from Irrelevant Alternatives
IID	Independent and Identically Distributed
LL	Log Likelihood
MNL	Multinomial Logit
MRS	Marginal Rate of Substitution
MWTP	Marginal Willingness to Pay
PAVA	Pooled Adjust Violator Algorithm
RP	Revealed Preference
RUM	Random Utility Model
SE	Standard Error
SP	Stated Preference

SPO	State Planning Organization
SRS	Simple Random Sample
SVF	Subjective Value of Fatality
SVI	Subjective Value of Injury
SVTT	Subjective Value of Travel Time
TL	Turkish Lira
TRNC	Turkish Republic of Northern Cyrus
USD	United States Dollar
VI	Value of Injury
VRR	Value Risk Reduction
VSL	Value of a Statistical Life
VTTS	Value of Travel Time Saving
WTA	Willingness to Accept
WTP	Willingness to Pay
YTL	New Turkish Lira

Chapter 1

INTRODUCTION

1.1 The Problem of Road Safety

The issue of deaths and injury as a consequence of road accidents is now recognized to be a global problem with authorities in countries of the world dealing with the increase in the number of deaths and people seriously injured on their roads (Jones-Lee, 1994; Despontin et al., 1998; Rizzi, 2003; Hojman et al., 2005; Andersson, 2007; European Transport Safety Council, 2007; Elvik et al., 2009; Gopalakrishnan, 2012)

During last few years, on average approximately 1.17 million people died in traffic accidents worldwide. Of the deaths, around 70% happened in developing countries. Each year more than 10 million are disabled or injured. Unless immediate measures are taken, these numbers have been estimated to increase greatly over the next decades. In 2014 there were 1.3 million fatalities on the word's roads. Approximately 92% traffic deaths took place in low and middle-income countries. These countries contain 53% of registered vehicles in the world (World Bank, 2014).

In Turkey as upper middle-income country approximately 3,770 people died and more than 255,000 were injured because of traffic accidents in last five years. In other words, more than 10 people have been killed and over 700 persons have been

injured everyday due to traffic accidents (Table 1.1). [1]

Table 1.1: Estimation of Road Causalities in the Turkey between 2010-2014

Year	Number of Accidents	Number of Fatalities	Number of Injuries
2010	1,106,201	4,045	211,496
2011	1,228,928	3,835	238,074
2012	1,296,634	3,750	268,079
2013	1,207,354	3,685	274,829
2014	1,199,010	3,524	285,059

Source: General Directorate of Public Security and General Command of Gendarmerie

These significant numbers of death and injuries are not limited to developing and under developed countries. Taking European Union for instance, about 29,000 people died and over 1,438,000 were injured owing to traffic accidents (Table 1.2).[2]

[1] Turkish statistical institute on January 2015, http://www.turkstat.gov.tr/Start.do
[2] The Organization for Economic Co-operation and Development (OECD), https://data.oecd.org/transport/road-accidents.htm

Table 1.2: Estimation of Road Causalities in the European Union between 2010-2013

	Number of Accidents				Number of Injuries				Number of Fatalities			
Year	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
Austria	35348	35129	40 831	38502	45858	45025	50895	48044	552	523	531	455
Belgium	45918	47945	44234	41279	60363	62861	57763	53967	841	862	770	724
Bulgaria	6609	6639	6717	7015	8078	8301	8 193	8775	776	657	601	601
Croatia	13272	13228	11773	11225	18333	18065	16 010	15 274	426	418	393	368
Czech	19676	20487	20504	20342	24384	25549	25515	25288	802	773	742	654
Denmark	3498	3525	3124	2984	4153	4039	3611	3394	255	220	167	191
Estonia	1346	1494	1383	-	1719	1879	1707	-	78	101	87	81
Finland	6072	6408	5725	5334	7673	7931	7088	6681	272	292	255	258
France	67288	65024	60437	56812	84461	81251	75851	70607	3992	3963	3653	3268
Germany	288297	306266	299637	291105	371170	392365	384378	374142	3648	4009	3600	3339
Greece	15032	13849	12398	12072	19108	17259	15640	14812	1258	1141	988	874
Hungary	16308	15827	15174	15691	20917	20172	18979	20090	740	638	605	591
Ireland	5780	5230	5376	5885	8270	7235	7597	8795	212	186	162	189
Italy	211404	205000	186726	181227	302735	292000	264716	257421	4090	3800	3653	3385
Latvia	3193	3386	3358	3489	4023	4224	4179	4338	218	179	177	179
Lithuania	3530	3266	3391	3391	4230	3919	3951	4007	299	296	302	256
Luxembourg	787	962	1019	949	1059	1308	1378	1252	32	33	34	45
Malta	13727	14624	14546	314	1064	1560	1590	1564	15	17	9	18
Netherlands	3853	10778	4968	9522	3651	5813	5533	10629	640	661	650	570
Poland	38832	40065	37062	35847	48952	49501	45792	44059	3907	4189	3577	3357
Portugal	35426	32541	29867	30339	46365	41960	38105	38753	937	891	718	637
Romania	25996	26648	26928	24827	32414	33491	34209	31464	2377	2018	2042	1861
Slovak	6570	5775	5370	5113	8150	7057	6438	6311	353	325	352	251
Slovenia	7560	7218	6864	6542	10316	9673	9148	8742	138	141	130	125
Spain	85503	83027	83115	89519	120345	115627	115890	124720	2478	2060	1903	1680
Sweden	16500	16119	16458	14816	23305	2360	22825	20259	266	319	285	260
UK	160080	157068	151346	14442	215700	210750	202931	190923	1905	1960	1802	1770
Total	1,130,400	1,123,000	1,080,400	1,055,400	1,502,200	1,282,600	1,433,700	1,389,800	31,500	30,700	28,200	26,000

Source: CARE (EU road accidents database) or national publications European Commission / Directorate General Energy and Transport

In order to evaluate investments in road safety and make national decreases on the allocation of expenditures, governments in developing countries need to have reliable estimates of direct and indirect monetary cost and social impacts of traffic incidences on the country's economy.

1.2 Road Safety in North Cyprus

Cyprus is the third largest island in the Mediterranean. The northern part of the island comprises about a third of the total land area of the island. In North Cyprus, the available modes of transport are road, sea, and air, and there are no railways in the country. All inter-urban transport is by road. In 2012 there were 260,084 registered motor vehicles (Figure 1.1), while the number of driving licenses issued was 419,030 (Figure 1.2). Of the 7,000 km of roads in North Cyprus, about two-thirds are paved (Figure 1.3). The average distance between the five districts of Northern Cyprus is 47.68 km (Table 1.3).[3]

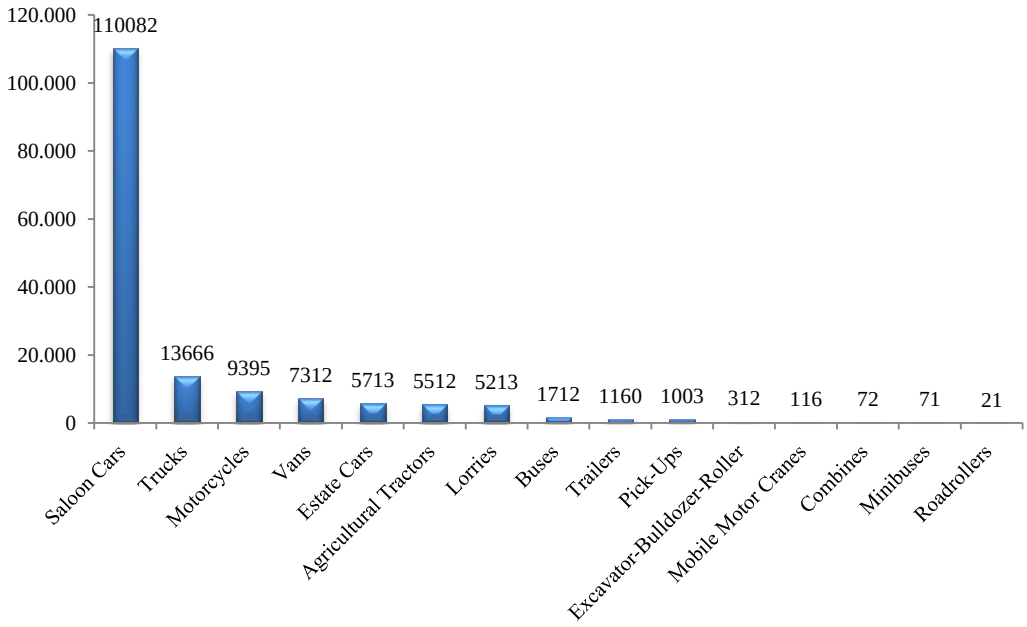

Figure 1.1: Registered Motor Vehicles by Type of Vehicle
Source: Statistical Yearbook 2012

[3] https://en.wikipedia.org/wiki/Northern_Cyprus#Infrastructure

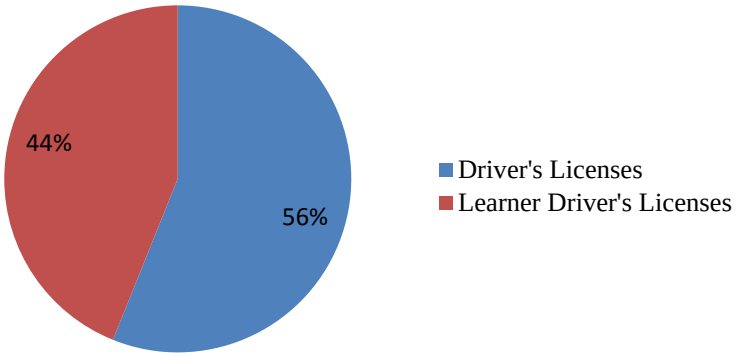

Figure 1.2: Number of Driving Licenses Issued
Source: Statistical Yearbook 2012

Table 1.3: Road Distances in Northern Cyprus

District	**Distance (kms)**	
Lefkoşa		
	Gazimağusa	60.66
	Girne	25.74
	İskele	60.18
	Güzelyurt	40.06
Gazimağusa		
	Girne	73.53
	İskele	19.5
	Güzelyurt	95.25
Girne		
	İskele	73.85
	Güzelyurt	47.95
İskele		
	Güzelyurt	94.93

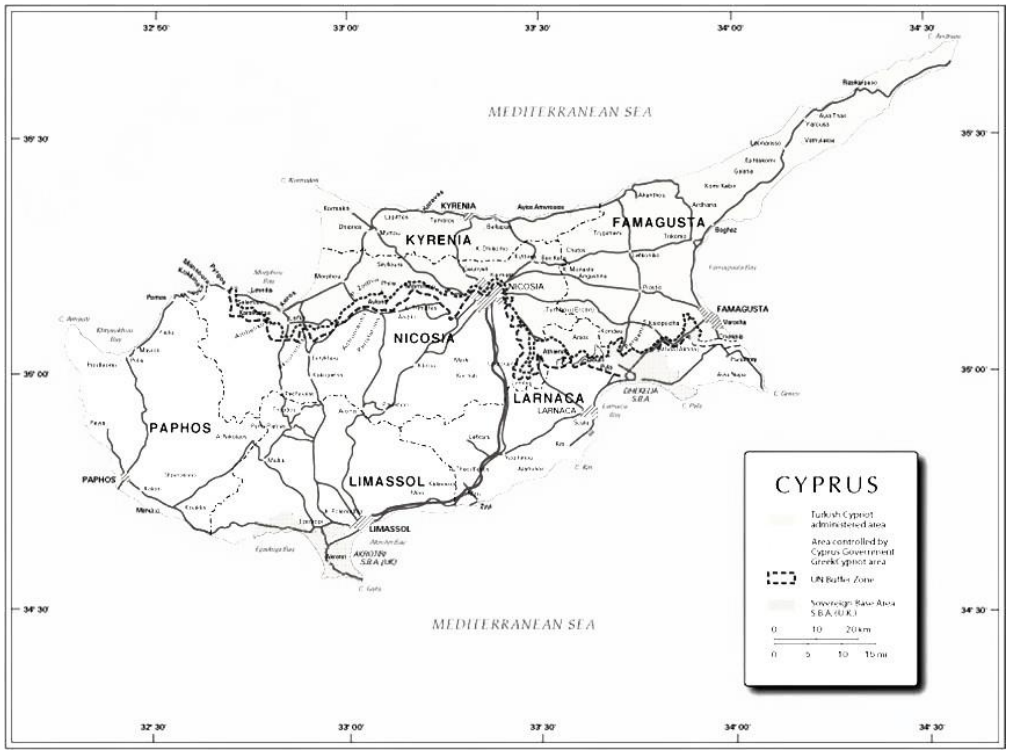

Figure 1.3: Major roads in Cyprus

According to the 2012 Census, North Cyprus had a population of 286,257. The average age of the population of North Cyprus in 2012 was 33, while the life expectancy for males is 79.6 years and for females it is 83.1 years. The annual per capita gross national income (GNI) in 2014 was €10,989. In 2014 the official minimum wage was TL1, 675 (€ 572) per month (€ 6864 per year). The gross domestic product (GDP) is derived heavily from tourism (21%) and higher education services (11.5%), with a further 12% coming from transportation and communications. [4]

The rate of unemployment in 2014 was 8.3% (Economic and Social Indicators, 2014). Because North Cyprus is a small island country with eight universities serving both the local and the international markets, much of the unemployment consists of

[4] http://nufussayimi.devplan.org/index-en.html/index-en.html, 2012 census

recent graduates who are seeking local professional employment and who often end up moving to Turkey or to other EU countries to find such jobs. At the same time more than 25,000 guest workers from Turkey were employed in virtually every occupation in North Cyprus (Economic and Social Indicators, 2014). Hence, unemployment is largely a function of young people not finding the quality of jobs they are looking for, given their option of working abroad, rather than the absence of available jobs. Owing to a strong extended family tradition and a generous social security system, the incidence of poverty among the Turkish Cypriots is quite low.

Over the period 2010 to 2014, North Cyprus experienced, on average, 40 road accident fatalities per year, or 140 fatalities per million population (Table 1.4). The incidence of fatalities from automobile accidents is 2.75 times greater than the average for Western Europe over the same period. The incidence of various non-fatal injuries is about 1.29 times greater than the average for Western Europe over the same period (2012 Census; European Commission Road Safety Statistics website, 2014; Road Traffic Accident Prevention Association, 2014). [5]

Table 1.4: Estimation of Road Causalities in Northern Cyprus

Year	Number of Accidents	Number of injuries (Per million)	Compare with EU	Number of Fatalities (Per million)	Compare with EU
2010	4461	4262	3004	147	63
2011	4109	4853	2969	157	61
2012	3889	3364	2867	91	56
2013	4037	2994	2779	164	52
2014	4132	3161	2834	140	51

Source: Statistical Yearbook 2011 and Road Traffic Accidents Prevention Association

[5] http://ec.europa.eu/transport/road_safety/specialist/statistics/index_en.htm, http://ec.europa.eu/eurostat/help/new-eurostat-website

By comparison, the number of industrial accidental deaths in North Cyprus over the same period averaged five per year (Table 1.5), with an average of 247 non-fatal accidents per year (Turkish Republic of Northern Cyprus, Ministry of Labor and Social Security, 2015). The annual rate of non-fatal accidents is 0.2% in North Cyprus, while for the average for the labor force in the EU it is 1.6% (Eurostat, 2015). While safety in the work place in North Cyprus appears to be relatively better than in the EU, the level of safety in automobile transportation is much worse.

Table 1.5: Estimation of Industrial Causalities in Northern Cyprus

Year	Number of Accidents	Number of Deaths	Number of Injuries
2010	285	2	283
2011	277	7	270
2012	218	4	214
2013	237	7	230
2014	244	6	238

Source: Turkish Republic of Northern Cyprus, Ministry of Labor and Social Security, 2015

The main cause of traffic accidents in North Cyprus is the behavior of drivers (80%), including speeding, alcohol, lack of attention, inadequate sleep, reckless driving, and non-compliance with the traffic signs (Figure 1.4). The second most important cause is the road environment (20%) or the road layout, including road bends, narrow carriageways, mud deposits, animals or other objects in the carriageway, poor and defective road surfaces, inadequate road signs or markings, and lack of traffic signals. On the other hand, driving licenses are issued without examination to foreigners who already have a driving license from elsewhere. This is particularly dangerous for a small country with an international university student population of over 50,000, and many long-term tourists from countries with lax driving regulations. There is not even an official handbook for learner drivers to study the

rules for their written examination. Young children and citizens aged 21–44 years are found to be the most vulnerable road users (Road Traffic Accident Prevention Association, 2014). [6]

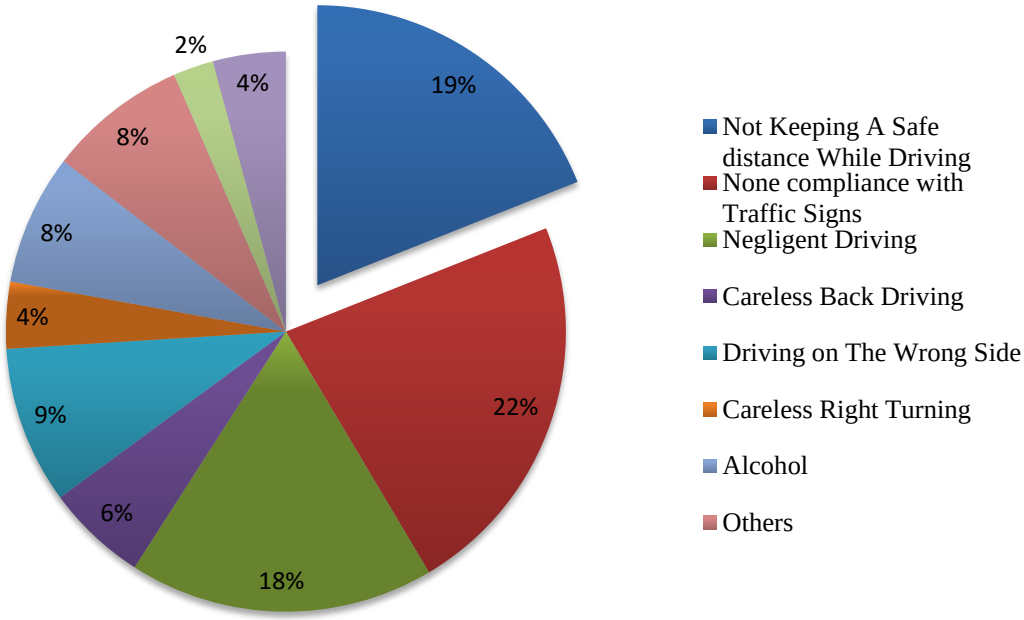

Figure 1.4: Traffic Accidents In North Cyprus by Causes
Source: Statistical Yearbook 2012 and Road Traffic Accidents Prevention Association

In addition to the direct pain and suffering incurred, traffic accidents can cause poverty in families through the loss of a key caregiver, loss of productivity, loss of income, cost of medical care, damage to property, rehabilitation, and burial costs. The large number of victims created by traffic accidents and the seriousness of the consequences represent a major economic and public health problem (Gopalakrishnan, 2012).

Reducing these major social problems, which have economic consequences, will require the selection and implementation of many new investments in the areas of

[6] Road Traffic Accidents Prevention Association, 2014, www.tkodkk.org

road transport, road safety, and driver education. While the road network is fairly extensive, it is generally of low quality. Highways between cities need to be widened with adequate road breakdown lanes; overpasses need to be built at important highway junctions; barriers are needed to separate traffic moving in opposite directions on high-volume expressways with lane dividers installed or improved on busy urban streets; and modern roundabouts need to be built to replace many existing small roundabouts or busy four-way stop junctions. The important task will be to select those projects, from the many possible ones proposed, that could be justified on the basis of cost–benefit analysis (CBA) or cost–effectiveness analysis (CEA). To conduct such appraisals, a number of key parameter values are required. Three such parameters are the value of time saved by individuals in travel from road improvements, the value per life saved or value of a statistical life (VSL) and the value of injury prevented (VI) through the reduction of traffic accidents as a result of improvements in road safety.

Unfortunately, estimates of these values are not currently available for most developing countries. The objective of our research is to obtain credible estimates of these parameters for Turkish Republic of Northern Cyprus (TRNC).

1.3 Road Safety and Willingness To Pay

In Northern Cyprus, there are some plans for the road safety measures. Hence, for calculating the economical advantages of road safety improvement and the human costs of traffic casualties properly, an approach in welfare economics theory called the willingness to pay is to be evaluated.

WTP is the marginal rate of substitution (MRS) between the risk of fatalities (or

injuries, travel time) and income (Drèze, 1962; Jones-Lee, 1974; Hojman et al., 2005; Hensher et al., 2009; Veisten et al., 2013). The use of WTP in the road environments to find the subjective value of traffic casualties or other indirect subjects falls under the concept of value risk reduction (VRR). VRR is equal to the value of avoiding premature fatality per unit of time within the aggregating demand for this public good, in this case road safety.

Although North Cyprus has experienced exceptionally high fatality and injury rates from car accidents, this is the first study to elicit the road safety preferences of car drivers. Given the very high incidence of road fatalities and injuries in North Cyprus as compared with that in the rest of the Western world, many investments in this area need to be undertaken to reduce the current level of casualties. The important task will be to select those projects, among the many possible ones, that can be justified on the basis of cost–benefit analysis (Jenkins et al., 2014). In terms of policy tools, our findings provide a set of information on the VRR that is useful in the ex ante appraisals of road projects that not only reduce travel times and vehicle operating costs but that also have been shown to be effective in reducing highway fatality and injuries.

Therefore, we evaluate preference of drivers for improving road safety by using the choice experiment (CE) method. This method cannot measure directly. Their approach relies on hypothetical scenarios to measure the non market value of individual's preference on road safety improvement through questionnaire.

Several pilot questionnaires were completed prior to the actual survey. Participants from the five districts of North Cyprus were interviewed by trained interviewers to

discuss their opinions and suggestions on road safety, driving, and accident experience on the road, with the goal of revealing directly and indirectly their WTP. Econometric models are used for data evaluation.

The remainder of this thesis is presented into seven chapters. Chapter 2 is dedicated to available literature review for valuation methodologies and approaches, which are suitable for estimating drivers WTP for road safety. This chapter describes the principles underlying the microeconomic theory in road environment using discrete choice models.

Chapter 3 contains a description of the method for designing the CE that enables us to express the alternatives in terms of combinations of different attributes at different levels based on the statistical optimality. Moreover, we discuss about the effects of the CE design on the WTP evaluation. We then outline the main steps for designing the CE approach.

In Chapter 4, presents the different stages of the questionnaire development, and the main survey. We describe questionnaire design in detail and the results from focus groups. Some changes were made in the actual survey after considering the feedback from the focus groups in the pilot questionnaires. Moreover, it contains various methodological issues for the administering of the main survey. Finally, we report the descriptive statistics from the main survey data.

Chapter 5 presents the results from the CE method. First, summary of descriptive statistics on the choice sets are presented. We then evaluate and compare all the parameters by using some of the CE models such as the multinomial logit (MNL);

the mixed logit (ML); and the mixed logit with interactions in terms of fit model. At the end of chapter, we estimate the WTP of drivers by using the compensating variation (CV) for various road safety improvement scenarios.

Chapter 6 contains the discussion of the results of the analysis, and our conclusions. We compare our results with those from other studies that used similar methodologies and that are presented in the literature for estimating the improvement in road safety. Finally, In terms of policy tools, our findings provide a set of information on the VRR that is useful in the ex ante appraisals of road projects and the suggestion areas that are potentially fruitful for future research in road environments.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

In the previous chapter, we briefly explained the general issue of fatality and injury as a consequence of road accidents in low and middle-income countries. We focused on the current road safety and the use of this study in the evaluation of improvements in the road environment in North Cyprus. This chapter will present two different methods for estimating the welfare effect and WTP of individuals for road safety improvement.

The two main methods for evaluation of the WTP in environmental economics are revealed preference (RP) and stated preference (SP). The revealed preference approach measures the actual behavior of individuals or market value of goods for making decisions in their consumption choices. Stated preference approach on the other hand, does not measure directly.

This method relies on hypothetical scenarios to measure the non market value of individual's consumption choices through surveys. In this study we use stated preference method that includes CE to estimate preference of individual for road safety improvement. (Viscusi et al., 1991; Jones-Lee et al., 1993; Boxall et al. 1996; Adamowicz et al. 1998; Rizzi and Ortúzar, 2003; Foster and Mourato 2003; Iragüen and Ortúzar, 2004; Hensher et al. 2005; Rizzi and Ortúzar, 2006; Mogas et al. 2006;

Hensher et al., 2009; Svensson and Johansson, 2010).

2.2 Contingent Valuation Method

The contingent value method (CVM) proposed by Ciriacy-Wantrup (1947) and was first applied by Davis (1963). In this approach individuals are directly asked to state their maximum WTP for the non market value of goods whose, demand is unobservable. However, this method has been criticized by some economists (Diamond and Hausman, 1994; Hausman, 1993). They have pointed out that a common defect of contingent valuation studies arises from the embedded effect where people have a positive feeling or WTP about supporting an activity in general. Often the valuations people make of public goods are not consistent when they are asked to state their preferences for a series of interventions separately as compared to their valuation of the interventions when bundled together. This problem is at least partially solved in situations when one is able to observe direct expenditures made by individuals on averting or coping activities in order to alleviate the situation that is the focus of the contingent valuation.

2.3 Choice Experiment Method

The choice experiment (CE) techniques initially have been used in the marketing and transport studies by Louviere and Hensher (1982) and Louviere and Woodworth (1983). In this experiment individuals are asked to choose between different alternative combinations and levels of alternative service attributes for estimating marginal WTP (MWTP) for each service attribute (Iragüen and Ortúzar, 2004; Rizzi and Ortúzar, 2006; Hensher et al., 2009; Svensson and Johansson, 2010). Therefore, CE implicitly reveals the actual behavior of people and is a more appropriate technique for the non market value (McFadden, 1998). In the case of road safety, the actual decision that people make involves choosing between bundles of attributes

that describe alternative routes. Hence, it is necessary to estimate the values of each of the attributes that can be bundled into different combinations to describe the services received from the various routes.

2.4 Model Specification and Estimation

The random utility model (RUM) is a common theoretical framework among the CVM and CE methods (McFadden, 1973; Greene 1997). As we cannot observe all the relevant information in the utility function, let U_{ji} denote the random utility function of alternative i perceived by individual j, which in turn is expressed as a deterministic V_{ji} and a random component ε_{ji}:

$$U_{ji} = V_{ji} + \varepsilon_{ji} \quad (1)$$

In the CE model, the probability of utility that individual *j* associates with alternative *i* be formulated as:

$$P_{ji} = P\{V_{ji} + \varepsilon_{ji} > V_{jk} + \varepsilon_{jk} \; ; \; \forall \; k \in A\} \quad (2)$$

Where *A* denotes the set of possible alternatives and *k* denotes the other alternative. The probability of choosing alternative *I* with Extreme Value type I (EVI) distribution in ε among alternatives and across individuals in choice set *c*, is:

$$P_{jci} = \frac{\exp^{\lambda V jci}}{\sum_{j=1}^{J} \exp^{\lambda V jci}} \quad (3)$$

$$\lambda = \frac{\pi}{\sqrt{6\,\sigma}}$$

where λ is know as a scalar factor and typically constant (typically assumed to be one.)

We assume $V_{jci} = \beta X_{jci}$ as a description of the to linear and additive utility function of alternative i in choice set c perceived by individual j for vector of attributes. The parameters vector (β) of utility function estimates by using maximum likelihood

technique. Then the MWTP and total WTP for changes in levels of attributes are presented by:

$$\text{MWTP} = \frac{\partial V/\partial X_k}{\partial V/\partial C} = \frac{\beta_k}{-\beta_c} \quad (4)$$

$$\text{WTP} = \sum_{k=1}^{K} \frac{\beta_k}{-\beta_c}(\Delta X_k) \quad (5)$$

Where X_k denotes the k^{th} attribute and C denotes the cost attribute.

The CE method has potential advantages to CVM in terms of accuracy that each of the attributes are given equal examination (Bennett, 1996; Hanley et al. 1998; Swait and Adamowicz, 2001). In addition, CE results can be used to estimate the compensation variation (CV) for specific changes in environmental quality as compare to the initial condition (Mogas et al., 2006). However, the issues like lexicographic decision i.e. repondents picked an alternative that was uniquely better on one of the most important attributes, the design of the experiments and their complexity should be considered (Saelensminde, 2001; Adamowicz and Boxal, 2001).

2.5 The Economic Welfare Impact of Improving Road Safety

The economic welfare impact of improving road safety is estimated by the compensating variation (CV). This method evaluates the maximum WTP of the individual that is taken from their income to improve the level of the quality from initial level of safety (S^0) to new level of safety (S^1) to make him or her better off (Silberberg and Suen, 2001). Hence, this can be represented as:

$$V(P^0, S^0, Y) = V(P^0, S^1, Y - CV) \quad (6)$$

Where P^0 denotes the price and Y denotes the individual's income. In terms of expenditure function can be calculated as follows:

$$CV = e(P^0, S^0, U^0) - e(P^0, S^1, U^0) \quad (7)$$

Where U^0 is the respondent's level of utility with the current route of S^0.

2.6 The Value of Risk Reduction

Through the quantification of the benefits of improved road safety and the measurement of the WTP to reduce casualty risk, one can obtain a measure of VRRs for fatality (or injury) (Fischhoff, 1990; Viscusi, 1993; Andersson, 2007; Elvik et al., 2009). These parameters have traditionally been measured using CVM which basically express the risk of accidents as the probability of an accident occurring (Jones-Lee et al., 1993). In contrast the CE technique measures the VRRs based on estimates of drivers' WTP for incremental or marginal improvements in road safety. This is not an estimate of the total value of road safety but an attempt to measure the economic welfare benefits arising from interventions that improve road safety on the margin. In the case of road safety, the actual decision that people make involves choosing between bundles of attributes that describe alternative routes. Hence, it is necessary to estimate the values of each of the attributes that can be bundled into different combinations to describe the services received from the various routes.

The VRR estimates the value of preventing premature fatality or injury per unit of time within the aggregating demand for this public good, in this case road safety (Drèze, 1962; Jones-Lee, 1974). This is expressed as:

$$\mathrm{VRR} = \frac{1}{\mathrm{N}}\sum_{\mathrm{j}=1}^{\mathrm{N}} \mathrm{MRS_j} + \mathrm{N}\ \mathrm{cov}\left(\mathrm{MRS_j}, \left|\delta \mathrm{r_j}\right|\right) \quad (8)$$

Where N is members of the population, MRS_j is equal to rate of exchange between the risk of fatality (or injury) and income for each individual that is then summed over the entire population, plus a covariance between the MRS_j and the reduced risk (δr_j).

2.7 Benefit Transfer Approach

Researchers sometimes apply the benefit transfer approach to assess the value of the benefits of estimation. This approach to measuring the result from available studies and then adjusts the results to make them transferred from one situation to another. This adjustment reflects the differences between the study and the primary research results.

Value transfer estimates in two ways which is unadjusted and adjusted approach. The unadjusted value implies to similar context and socio-economic characteristics, physical characteristics and the market conditions between the studies. Whereas, the adjusted value modifies the results from the study which is conducted in country A based on different factors in Country B. One of the most common adjustment factors is GNI (Bateman et al., 1999; Bateman et al., 2002). However, depending on the situation, many other differences between the conditions of the original study and the intervention being evaluated can be accounted for using the benefit transfer method . The most commonly formula that adjusts for different levels of GNI is as follows:

$$\left[WTP_A = \mathrm{WTP}_B(GNI_A \,/\, GNI_{\ B})^{Elasticity}\right] \quad (9)$$

or

$$\left[VSL_A = \mathrm{VSL}_B(GNI_A \,/\, GNI_{\ B})^{Elasticity}\right] \quad (10)$$

2.8 Empirical Studies

Elvik (1995) performs a meta-analysis of 169 estimates of the mean and median VSL in the road environments compare to occupational safety. The data used in his research derived from stated and revealed preference methods. He computes several scenarios which are the mean and median VSL within the types of activities, different amount of sample size, pilot questionnaire, pubic good versus private good,

WTP values versus WTA values and then compares the means between groups. He finds that there is a higher estimated value of the mean of the VSL from occupational safety; poorly questionnaire designed and lower risk levels.

Miller (2000) estimates VSL from 68 studies of road and occupational risks based on stated and revealed preference methods in 13 countries that are strongly dependent on income levels. In this study the income elasticity ranges from 0.85 to 1.00 across countries. The average VSL estimated was 120 times per capita income. In addition, he used benefit transfer function to estimates VSL for any developed or developing countries given per their capita GDP. The estimate of the VSL for the European union ranged between $2.5 million and $3.6 million in 1995 dollars.

De Blaeij et al. (2003) focuses on a meta-analysis of 30 studies based on stated and revealed preference methods that are conducted in the USA and some European countries from 1973 to 2001. The VSL for road safety was estimated within a wide range from around $ 200,000 to $30 million. Of these 30 studies, 18 presented lower and higher estimates and 12 gave single point estimates. The authors find that VSL linked to level of the initial risk and risk reduction. Significant differences are found between RP and SP methods, which imply the RP, had lower estimates than the SP studies.

Rizzi and Ortuzar (2003) assert a specific trip on a special road based on CE method to tackle the problem of insensitivity to scope. These authors assert that people do not perceive risks in terms of objective probabilities but rather in terms of actual number of accidents or fatalities.

On the basis of that rationale, the absolute number of accidents in a day with at least one fatality is chosen as the proxy variable for risk. This article details the results from three surveys that use the stated choice framework and contained similar statistical designs — two interurban surveys by Rizzi and Ortuzar and one urban survey by Iragüen and Ortúzar. Respondents were told that they would be driving a car on a specified route and that they would have to pay a toll and travel at a specified time. In each of the questions, respondents were given two choice scenarios with three varying attributes — time of the accident, toll, and number of the fatality accidents. Nine choice questions were presented in each survey. The authors found that the subjective value of accident reductions (SVAR) and VRR were greater for the riskier scenario. If VRR is considered identical in the first two samples (interurban studies), then VRR is obtained as USD 759, 837. VRR for the third urban survey is USD 290,009. Using data from three surveys show the size of the risk reduction has a significant impact on the increase in VRR. Thus, by using a proxy variable for mortality risk, they estimate the sensitivity of WTP to the risk reduction.

Chapter 3

CHOICE EXPERIMENT DESIGN

3.1 Introduction

The stated CE method is seen as an extension of contingent valuation to which basically express the risk of accidents as the probability of an accident occurring in economics theory (Viscusi et al., 1991; Jones-Lee, 1994; Carthy et al., 1998). The contingent valuation approach involves a monetary valuation of road safety that implies a tradeoff between money and risk. These evaluation techniques are flawed, as the actual decision that people make involves choosing between bundles of attributes that describe alternatives (Adamowics et al. 1998). Therefore, CE implicitly reveals the actual behavior of people and is a more appropriate technique for non market values (McFadden, 1998; Louviere et al., 2000).

In this chapter, we will review the design objectives, the strategy of trade-offs and examine the different designs that are used in various studies to find the optimal design for generating the choice sets to be used in the survey.

3.2 Structure of CE Design

3.2.1 Principles

The design structure of the CE consists of four important principles, namely identification; precision; cognitive complexity; and market realism (Louviere et al., 2000).

Identification

The utility function should be identified. It can be a linear or non-linear function of the main effects only or with interactions.

Precision

Designs with more precision in parameter estimates have smaller confidence intervals, which is decided subject to budget constraints and greater variance efficiency.

Cognitive Complexity

Identify and generate all the possible alternatives within choice sets.

Realism

In the design structure is very important that the choice sets are descriptive of the actual situation that the respondents used for a real market.

To identify and select the most appropriate attributes on which to build an uncomplicated and representative choice experiment questionnaire on road safety improvements are needs to first review the literature relating to CE studies on road traffic. Particular attention has to be given to the design efficiency. After one identifies the attributes and the respective levels then the choice sets to present to each individual are constructed based on a design technique with the purpose of extracting the maximum amount of information from the individuals (Louviere et al., 2000).

3.2.2 Optimal Statistical Design

The efficient optimal statistical design has four desirable properties, namely orthogonality, level balance, minimal overlap, and utility balance (Huber and Zwerina, 1996).

In this way, orthogonality was satisfied when any two columns of attribute levels were uncorrelated with each other in the correlation matrix and therefore collinearity was minimized. Attribute level balance is satisfied when each level of an attribute appears an equal number of times in the files sets. Using modular arithmetic satisfies minimal overlap and ensuring that within each choice set the attribute levels do not overlap. The last principle of design efficiency, utility balance, is satisfied when the utilities have equal preferences for the alternatives (Carlsson and Martinsson, 2003).

A variety of design techniques are used to elicit the WTP in CE studies. The most common designs are the traditional orthogonal design, which is based on the variety of levels for each attribute independently, and the D-optimal design that requires some prior knowledge on the direction of the true parameter estimate. Of these, the latter is the most appropriate to estimate MWTP with higher precision (Carlsson and Martinsson, 2003; Scarpa and Rose, 2008).

3.2.3 Complexity

There are some criteria for assessing the complexity in the design of CE. Brief descriptions of a few studies that have been used in the complexity of the design in CE are presented in table 3.1.

Table 3.1: Selected Studies to Assess the Effectiveness of Complexity

Study	**Assess the complexity in design**	**Negative impact on the result of experiment by**
Caussade et al., 2005	Alternatives Attributes Levels of attributes Range of attributes levels Choice sets	Error variance
Carlsson and Martinsson,	Choice sets	Not significant effect

2006		
Hensher et al., 2005	Attributes	Significant different in WTPs
Hensher, 2006	Levels of attributes increases Ignored Attributes Range of attributes narrows Alternatives	Significant different in WTPs

3.2.4 Stated Choice Experiment Design and Estimation of WTP

The preference of respondents always is to choose the utility maximizing alternative that is uniquely better on one of the most important attributes in the choice models (Louviere et al., 2000). Therefore, the way of presented the prior information to respondents has a significant effect to the choice sets design (Lancsar and Louviere, 2006). We are better off by design a sample choice process (Shugan, 1980; Russo and Dosher, 1983; Swait and Adamowicz, 2001; Golek, 2005; Kjaer et al., 2006).

Ryan and Wordsworth (2000) evaluate the changes in the level of attributes into the estimate of WTP. Out of six attributes, they found five coefficients were statistically insignificant. However, four of those coefficients had significant MWTP.

Hanley et al. (2005) investigate whether the vector of prices affects the preferences and the WTP estimates. They find the rational behavior is exhibited by individuals in the estimations with the change in the vector of price. The preference of respondents to choose the alternative with low price vector is more than the others. However, this result does not have an impact on the probability of accepting to pay for improvement service.

Kjaer et al. (2006) examine the changes of the WTP with respect to the levels of

price attribute. They found that the WTP estimates are higher when the price attribute is presented in the beginning of the choice set to the individuals. Results indicate ordering effect of price attribute is significant.

Lancsar and Louviere (2006) search respondents' behavior and the data with irrationally characteristic were removed, as these respondents did not choose according to the CE aimed. However, they suggested to considering these data because the removing valid data cause the error in estimation and subsequently statistical inefficiency.

3.2.5 Status quo Alternative

To make the choice decision more realistic in the choice set, one of the alternatives in the choice set is a 'status quo ' or 'no-choice' alternative. This option will be chosen more frequently when none of the other alternatives in the choice set appear attractive (Dhar, 1997). In general, the status quo option is selected more when the choice sets are complex and when the respondent is not familiar with the choice sets (Beenstock et al., 1998; Johnson et al., 2000). There are some suggestions include introductory letter to the respondents explaining that the aim of the study, measuring task response times (Dhar, 1997; Golek, 2005; Rose and Black, 2006).

3.3 Process of Choice Experiment Design

Figure 3.1 presents the algorithm of CE design (Ryan and Hughes, 1997):

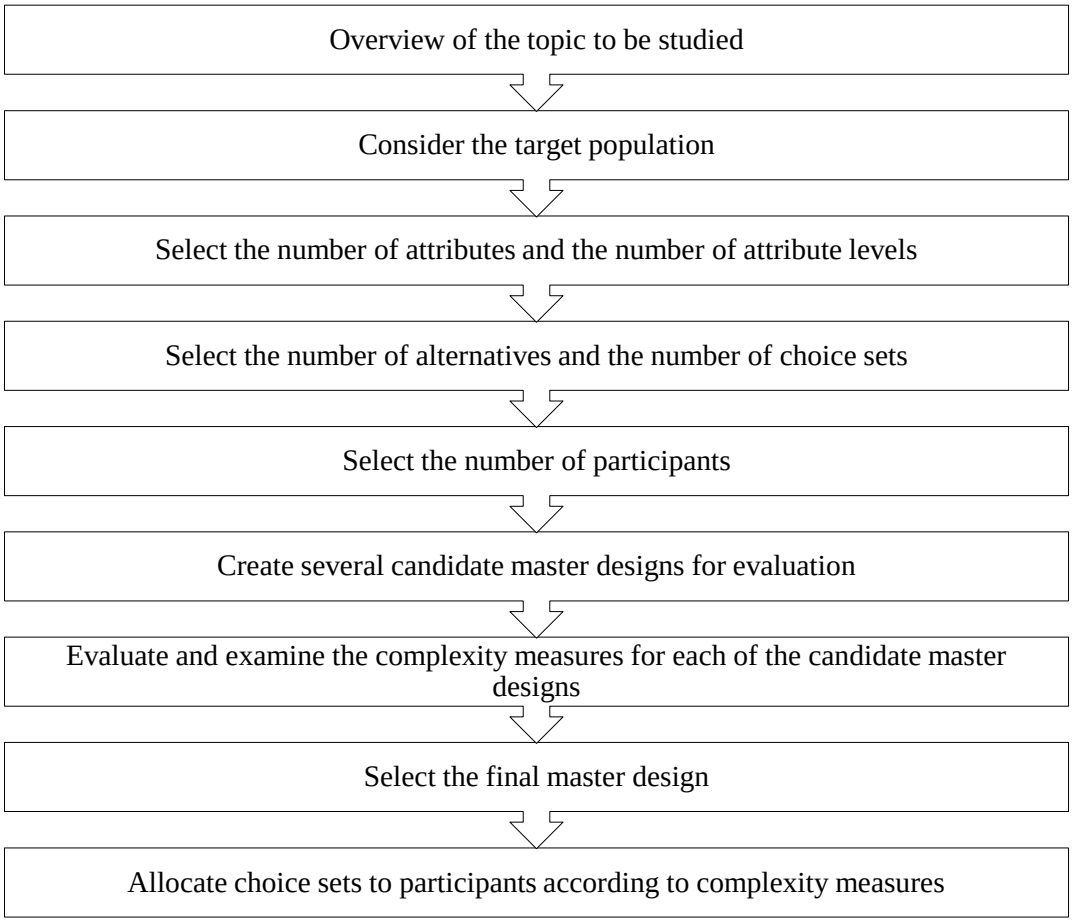

Figure 3.1: Algorithm of CE design

3.4 Process in a Choice Experiment Study

Figure 3.2 presents the algorithm in a CE study (Champ et al., 2003; Bliemer and Rose, 2005; Hensher et al., 2005; Orme, 2006; Barton, 2007) are:

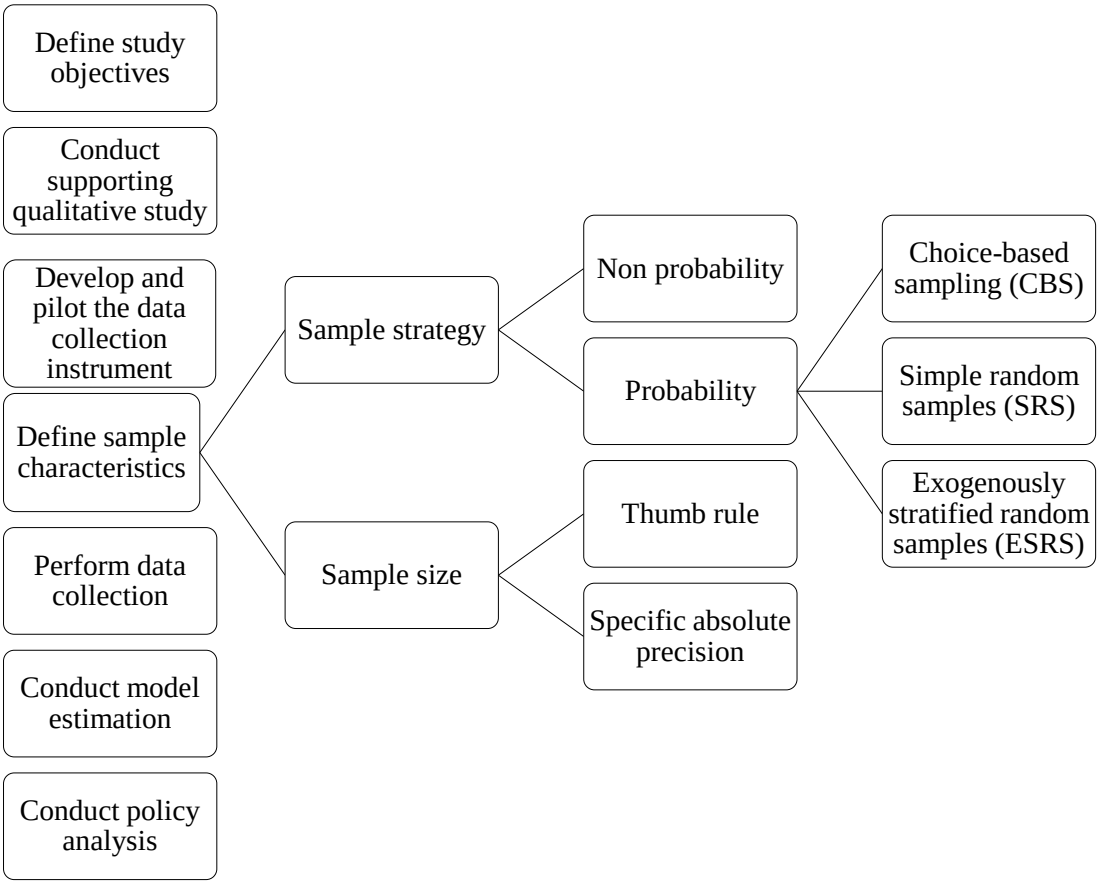

Figure 3.2: Algorithm in a CE Study

3.5 Attributes and respective Levels

3.5.1 Attributes Used in Road Environment Studies

Within a discrete choice framework the static indirect utility function V_{ji} is a linear and additive function of the attributes of the travel.[7] As we cannot observe all the relevant information in the utility function, let U_{jci} denote the random utility function of alternative *i* in choice set *c* perceived by individual *j*, which in turn is expressed as

[7] Some studies report their relationship to be nonlinear (Rizzi and Ortúzar, 2003).

a deterministic V_{jci} and a random component ε_{jci} :

$$U_{ji} = V_{ji} + \varepsilon_{ji}$$

If the model does not include an attribute that is important for the drivers in road environment it will lead to a misspecification in the estimations. Hence, we reviewed the literature relating to the CE studies on road environments to identify the appropriate attributes for building an uncomplicated and representative choice experiment questionnaire on road safety improvements (Table 3.2).

Table 3.2: Attributes Used in Previous Studies

Study	**Attributes**
Rizzi and Ortúzar, 2003	Travel time; toll charge; and annual accident rate
Iragüen and Ortúzar, 2004 Haddak et al., 2014	Travel time; travel cost; and number of fatal accidents per year.
Hojman et al., 2005	Travel time; toll charge; fatal victims per year; and Severely injured victims per year
Rizzi and Ortúzar, 2006	Toll value; number of fatal crashes; and en route travel time
Hensher et al., 2009	Number of speed Cameras; speed limits; total travel time (travel time spent in free flow condition and time spent in slowed down conditions); running costs; toll costs; number of deaths per year; number of severe permanent injuries per year; number of injuries requiring hospitalization per year; and number of minor injuries per year
Veisten et al., 2013	Travel time; toll cost; and safety in route

3.5.2 Sample Groups

Several pilot questionnaires were completed with five focus groups. Trained interviewers to discuss their opinions and suggestions on road safety, driving, and accident experience on the road interviewed a total of 40 drivers from the five main districts of North Cyprus. The summary of socio-demographics are presented in Table 3.3.

Table 3.3: Sample Group Socio-demographics

District	Participants	Ages	Gender	Participant level of Education
Lefkoşa	11	23 - 60	5 Male, 6 Female	High school - PhD
Gazimağusa	11	25 - 55	6 Male, 5 Female	High school - PhD
Girne	8	24 - 52	4 Male, 4 Female	High school - PhD
Güzelyurt	5	38 - 61	3 Male, 2 Female	Secondary school - PhD
İskele	5	23 - 61	3 Male, 2 Female	Secondary school - PhD

The identified attributes and their levels used in the initial design of the CE were confirmed by the data collected through the pilot questionnaires (Table 3.4).

Table 3.4: Attributes and Levels

Attributes	Levels
Average speed limits per km/h posted on 1 and 2 lane each-way sections of route	60, 80, 90, 100
Number of speed cameras located on 1 and 2 lane each-way sections of route	1, 2
Total travel time	60 min or less 61 to 120 min
Number of injuries per year, representing the number of people who have been injured in car accidents using this road	Fewer than 20 people 20 people or more
Number of fatalities per year, representing the number of people who have been killed in car accidents using this road	Fewer than 10 people, 10 people or more
Percentage change in monthly costs for the trip	5% higher than now 10% higher than now 15% higher than now 20% higher than now

3.6 Experimental Design

We constructed two unlabeled experiments in which the title of each alternative relates to two hypothetical routes. We used a full factorial design, which allows treatments or attribute level combinations of the main effects and higher-order interactions.

In this study we had six attributes. The full factorial design would have implied that there would be 256 ($4^2 \times 2^4$) choice sets. The large number of scenarios is too much of a burden on the respondents. The orthogonal design is used to reduce the number of choice sets to 32 files. Therefore, each respondent saw only eight of the 32 files during the questionnaire process (Winer, 197; Hensher et al., 2005).

Using SPSS 20.0 to construct 32 files, which are presented in Table 3.5. The orthogonal codes defined as (-3, -1, 1, 3) and (-1, 1) for four level and two level attributes respectively. We renamed the attribute columns as follow: column S was assigned to “Average speed limit”, column C to “Speed camera”, column T to “Travel time”, column CT to “Running costs”, column I to “Injuries”, and column F to “Fatal crashes”. Block was used as a column B that is used for sorting the files.

Table 3.5: Fractional Factorial Design

Files	S	C	T	CT	I	F	B
1	-1	-1	1	-1	1	-1	3
2	1	-1	1	3	-1	1	1
3	-3	-1	1	-3	1	1	3
4	3	1	-1	3	-1	1	3
5	-3	1	1	3	1	-1	1
6	-3	1	1	-1	-1	1	-1
7	3	-1	-1	-3	-1	-1	1
8	-1	-1	1	3	-1	1	-3
9	-1	1	1	-3	-1	-1	-1
10	3	-1	1	1	-1	-1	1
11	-3	-1	-1	1	1	1	3
12	-1	1	1	1	1	1	1
13	3	-1	1	-3	1	1	-1
14	-1	-1	-1	-1	-1	1	-3
15	1	1	1	-3	-1	-1	3
16	3	1	1	-1	-1	1	3
17	-3	1	-1	-1	1	-1	1
18	-3	-1	1	1	-1	-1	-3
19	1	-1	-1	3	1	-1	-1
20	1	1	-1	-3	1	1	-3
21	-1	-1	-1	3	1	-1	3
22	1	-1	-1	-1	-1	1	1
23	-1	1	-1	1	-1	-1	-1
24	1	1	1	1	1	1	-3
25	3	1	1	3	1	-1	-3
26	1	-1	1	-1	1	-1	-1
27	3	-1	-1	1	1	1	-1
28	3	1	-1	-1	1	-1	-3
29	-3	1	-1	3	-1	1	-1
30	-1	1	-1	-3	1	1	1
31	-3	-1	-1	-3	-1	-1	-3
32	1	1	-1	1	-1	-1	3

Note: B is an extra attribute as block.

By using MS Excel worksheet we generate all the possible interactions and their correlations (Table 3.6 and Table 3.7).

Table 3.6: Interactions Terms

Files	S	C	T	CT	I	F	B	SC	ST	SCT	SI	SF	SB	CT	CCT	CI	CF	CB	TCT	TI	TF	TB	CTI	CTF	CTB	IF	IB	FB
1	-1	-1	1	-1	1	-1	3	1	-1	1	-1	1	-3	-1	1	-1	1	-3	-1	1	-1	3	-1	1	-3	-1	3	-3
2	1	-1	1	3	-1	1	1	-1	1	3	-1	1	1	-1	-3	1	-1	-1	3	-1	1	1	-3	3	3	-1	-1	1
3	-3	-1	1	-3	1	1	3	3	-3	9	-3	-3	-9	-1	3	-1	-1	-3	-3	1	1	3	-3	-3	-9	1	3	3
4	3	1	-1	3	-1	1	3	3	-3	9	-3	3	9	-1	3	-1	1	3	-3	1	-1	-3	-3	3	9	-1	-3	3
5	-3	1	1	3	1	-1	1	-3	-3	-9	-3	3	-3	1	3	1	-1	1	3	1	-1	1	3	-3	3	-1	1	-1
6	-3	1	1	-1	-1	1	-1	-3	-3	3	3	-3	3	1	-1	-1	1	-1	-1	-1	1	-1	1	-1	1	-1	1	-1
7	3	-1	-1	-3	-1	-1	1	-3	-3	-9	-3	-3	3	1	3	1	1	-1	3	1	1	-1	3	3	-3	1	-1	-1
8	-1	-1	1	3	-1	1	-3	1	-1	-3	1	-1	3	-1	-3	1	-1	3	3	-1	1	-3	-3	3	-9	-1	3	-3
9	-1	1	1	-3	-1	-1	-1	-1	-1	3	1	1	1	1	-3	-1	-1	-1	-3	-1	-1	-1	3	3	3	1	1	1
10	3	-1	1	1	-1	-1	1	-3	3	3	-3	-3	3	-1	-1	1	1	-1	1	-1	-1	1	-1	-1	1	1	-1	-1
11	-3	-1	-1	1	1	1	3	3	3	-3	-3	-3	-9	1	-1	-1	-1	-3	-1	-1	-1	-3	1	1	3	1	3	3
12	-1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	3	-1	1	-3	1	1	-1	-3	3	-9	3	3	-3	-1	3	-1	-1	1	-3	1	1	-1	-3	-3	3	1	-1	-1
14	-1	-1	-1	-1	-1	1	-3	1	1	1	1	-1	3	1	1	1	-1	3	1	1	-1	3	1	-1	3	-1	3	-3
15	1	1	1	-3	-1	-1	3	1	1	-3	-1	-1	3	1	-3	-1	-1	3	-3	-1	-1	3	3	3	-9	1	-3	-3
16	3	1	1	-1	-1	1	3	3	3	-3	-3	3	9	1	-1	-1	1	3	-1	-1	1	3	1	-1	-3	-1	-3	3
17	-3	1	-1	-1	1	-1	1	-3	3	3	-3	3	-3	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	-1	1	-1
18	-3	-1	1	1	-1	-1	-3	3	-3	-3	3	3	9	-1	-1	1	1	3	1	-1	-1	-3	-1	-1	-3	1	3	3
19	1	-1	-1	3	1	-1	-1	-1	-1	3	1	-1	-1	1	-3	-1	1	1	-3	-1	1	1	3	-3	-3	-1	-1	1
20	1	1	-1	-3	1	1	-3	1	-1	-3	1	1	-3	-1	-3	1	1	-3	3	-1	-1	3	-3	-3	9	1	-3	-3
21	-1	-1	-1	3	1	-1	3	1	1	-3	-1	1	-3	1	-3	-1	1	-3	-3	-1	1	-3	3	-3	9	-1	3	-3
22	1	-1	-1	-1	-1	1	1	-1	-1	-1	-1	1	1	1	1	1	-1	-1	1	1	-1	-1	1	-1	-1	-1	-1	1
23	-1	1	-1	1	-1	-1	-1	-1	1	-1	1	1	1	-1	1	-1	-1	-1	-1	1	1	1	-1	-1	-1	1	1	1
24	1	1	1	1	1	1	-3	1	1	1	1	1	-3	1	1	1	1	-3	1	1	1	-3	1	1	-3	1	-3	-3
25	3	1	1	3	1	-1	-3	3	3	9	3	-3	-9	1	3	1	-1	-3	3	1	-1	-3	3	-3	-9	-1	-3	3
26	1	-1	1	-1	1	-1	-1	-1	1	-1	1	-1	-1	-1	1	-1	1	1	-1	1	-1	-1	-1	1	1	-1	-1	1
27	3	-1	-1	1	1	1	-1	-3	-3	3	3	3	-3	1	-1	-1	-1	1	-1	-1	-1	1	1	1	-1	1	-1	-1
28	3	1	-1	-1	1	-1	-3	3	-3	-3	3	-3	-9	-1	-1	1	-1	-3	1	-1	1	3	-1	1	3	-1	-3	3
29	-3	1	-1	3	-1	1	-1	-3	3	-9	3	-3	3	-1	3	-1	1	-1	-3	1	-1	1	-3	3	-3	-1	1	-1
30	-1	1	-1	-3	1	1	1	-1	1	3	-1	-1	-1	-1	-3	1	1	1	3	-1	-1	-1	-3	-3	-3	1	1	1
31	-3	-1	-1	-3	-1	-1	-3	3	3	9	3	3	9	1	3	1	1	3	3	1	1	3	3	3	9	1	3	3
32	1	1	-1	1	-1	-1	3	1	-1	1	-1	-1	3	-1	1	-1	-1	3	-1	1	1	-3	-1	-1	3	1	-3	-3

Table 3.7: The Main Attributes and Interactions Correlation

	S	C	T	CT	I	F	B	SC	ST	SCT	SI	SF	SB	CT	CCT	CI	CF	CB	TCT	TI	TF	TB	CTI	CTF	CTB	IF	IB	FB
S	1																											
C	0	1																										
T	0	0	1																									
CT	0	0	0	1																								
I	0	0	0	0	1																							
F	0	0	0	0	0	1																						
B	0	0	0	0	0	0	1																					
SC	0	0	0	0	0	0	0	1																				
ST	0	0	0	0	0	0	0	0	1																			
SCT	0	0	0	0	0	0	0	0,36	0	1																		
SI	0	0	0	0	0	0	-0,80	0	0	0	1																	
SF	0	0	0	0	0	0	0	0	0	0	0	1																
SB	0	0	0	0	-0,80	0	0	0	0	0	0	0,36	1															
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	1														
CCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1													
CI	0	0	0	0	0	0	-0,45	0	0	0	0	0	0	0	0	1												
CF	0	0	0	0	0	0	0	0	0	0	0	0	0,40	0	0	0	1											
CB	0	0	0	0	-0,45	0	0	0	0	0	0	0,40	0,72	0	0	0	0	1										
TCT	0	0	0	0	0	0	-0,40	0	0	0	0	0	0	0	0	0,89	0	0	1									
TI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,89	0	0	0	0	1								
TF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1							
TB	0	0	0	-0,40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1						
CTI	0	0	0	0	0	-0,45	0	0	0	0	0	0	0	0,89	0	0	0	0	0	0	0	0	1					
CTF	0	0	0	0	-0,45	0	0	0	0	0	0	0	0,36	0	0	0	0	0,2	0	0	0	0	0	1				
CTB	0	0	-0,40	0	0	0	0	0	0	0	0	0,36	0,16	0	0	0	0,2	0	0	0	0	0	0	0	1			
IF	0	0	0	-0,45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
IB	-0,80	-0,45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
FB	0	0	0	0	0	0	0	0,40	0	0,36	0	0	0	0	0,20	0	0	0	0	0	0	0	0	0	0	0	0	1

This design shows the two-way interactions SC, ST, SCT, SF, CT, CCT, CF, TI, TF and FB are uncorrelated.

Table 3.8: Using block Variable for Sorting Files

Files	S	C	T	CT	I	F	B
8	-1	-1	1	3	-1	1	-3
14	-1	-1	-1	-1	-1	1	-3
18	-3	-1	1	1	-1	-1	-3
20	1	1	-1	-3	1	1	-3
24	1	1	1	1	1	1	-3
25	3	1	1	3	1	-1	-3
28	3	1	-1	-1	1	-1	-3
31	-3	-1	-1	-3	-1	-1	-3
6	-3	1	1	-1	-1	1	-1
9	-1	1	1	-3	-1	-1	-1
13	3	-1	1	-3	1	1	-1
19	1	-1	-1	3	1	-1	-1
23	-1	1	-1	1	-1	-1	-1
26	1	-1	1	-1	1	-1	-1
27	3	-1	-1	1	1	1	-1
29	-3	1	-1	3	-1	1	-1
2	1	-1	1	3	-1	1	1
5	-3	1	1	3	1	-1	1
7	3	-1	-1	-3	-1	-1	1
10	3	-1	1	1	-1	-1	1
12	-1	1	1	1	1	1	1
17	-3	1	-1	-1	1	-1	1
22	1	-1	-1	-1	-1	1	1
30	-1	1	-1	-3	1	1	1
1	-1	-1	1	-1	1	-1	3
3	-3	-1	1	-3	1	1	3
4	3	1	-1	3	-1	1	3
11	-3	-1	-1	1	1	1	3
15	1	1	1	-3	-1	-1	3
16	3	1	1	-1	-1	1	3
21	-1	-1	-1	3	1	-1	3
32	1	1	-1	1	-1	-1	3

After the 32 files have been created, the following steps are need to generate the second set of alternative files from the first alternative by using shifted designs (Bunch et al., 1996).

- Adding modular arithmetic 1 to the attribute with two levels
- Adding modular arithmetic 1 and 2 to the attribute with four levels

We switched the orthogonal to design coding in order to use modular arithmetic which is (0, 1, 2, 3) instead of (-3, -1, 1, 3), and (0, 1) instead of (-1, 1) respectively (Table 3.9 and 3.10). We renamed the attribute columns to original name.

Table 3.9: Modular Arithmetic Codes of Route A

Block	Files	Speed limit	Speed camera	Travel time	Costs	Fatal crashes	Injuries
0	8	1	0	1	3	0	1
0	14	1	0	0	1	0	1
0	18	0	0	1	2	0	0
0	20	2	1	0	0	1	1
0	24	2	1	1	2	1	1
0	25	3	1	1	3	1	0
0	28	3	1	0	1	1	0
0	31	0	0	0	0	0	0
1	6	0	1	1	1	0	1
1	9	1	1	1	0	0	0
1	13	3	0	1	0	1	1
1	19	2	0	0	3	1	0
1	23	1	1	0	2	0	0
1	26	2	0	1	1	1	0
1	27	3	0	0	2	1	1
1	29	0	1	0	3	0	1
2	2	2	0	1	3	0	1
2	5	0	1	1	3	1	0
2	7	3	0	0	0	0	0
2	10	3	0	1	2	0	0
2	12	1	1	1	2	1	1
2	17	0	1	0	1	1	0
2	22	2	0	0	1	0	1
2	30	1	1	0	0	1	1
3	1	1	0	1	1	1	0
3	3	0	0	1	0	1	1
3	4	3	1	0	3	0	1
3	11	0	0	0	2	1	1
3	15	2	1	1	0	0	0
3	16	3	1	1	1	0	1
3	21	1	0	0	3	1	0
3	32	2	1	0	2	0	0

Table 3.10: Modular Arithmetic Codes of Route B

Block	Files	Speed limit	Speed camera	Travel time	Costs	Fatal crashes	Injuries
0	8	2	1	0	0	1	0
0	14	2	1	1	2	1	0
0	18	1	1	0	3	1	1
0	20	3	0	1	1	0	0
0	24	3	0	0	3	0	0
0	25	0	0	0	0	0	1
0	28	0	0	1	2	0	1
0	31	1	1	1	1	1	1
1	6	1	0	0	2	1	0
1	9	2	0	0	1	1	1
1	13	0	1	0	1	0	0
1	19	3	1	1	0	0	1
1	23	2	0	1	3	1	1
1	26	3	1	0	2	0	1
1	27	0	1	1	3	0	0
1	29	1	0	1	0	1	0
2	2	3	1	0	0	1	0
2	5	1	0	0	0	0	1
2	7	0	1	1	1	1	1
2	10	0	1	0	3	1	1
2	12	2	0	0	3	0	0
2	17	1	0	1	2	0	1
2	22	3	1	1	2	1	0
2	30	2	0	1	1	0	0
3	1	2	1	0	2	0	1
3	3	1	1	0	1	0	0
3	4	0	0	1	0	1	0
3	11	1	1	1	3	0	0
3	15	3	0	0	1	1	1
3	16	0	0	0	2	1	0
3	21	2	1	1	0	0	1
3	32	3	0	1	3	1	1

In terms of efficient choice design, we need orthogonality, level balance, minimal overlap, and utility balance (Huber and Zwerina, 1996). In this way, orthogonality

was satisfied when correlation matrix is constructed in such a way that any two columns of attribute levels were uncorrelated to each other. Therefore, collinearity is minimized. Attribute level balance is satisfied when each level of an attribute appears an equal number of times in the files sets. Minimal overlap is satisfied when the levels of attributes in Route A are shifted to produce Route B without having overlap within a levels of attributes. The last principle of design efficiency denotes to the utility balance that is satisfied by reducing utility difference among the alternatives (Carlsson and Martinsson, 2003).

In order to decreasing the utility difference among the alternatives, we determined the dominating files for Route A and Route B by estimating the code-sum difference between them (Table 3.11) (Carlsson and Martinsson 2008).

Table 3.11: Comparing the Code-Sum

Block	Files	Route A	Route B	Code sum difference
0	8	6	4	2
0	14	3	7	-4
0	18	3	7	-4
0	20	5	5	0
0	24	8	6	2
0	25	9	1	8
0	28	6	4	2
0	31	0	6	-6
1	6	4	4	0
1	9	3	5	-2
1	13	6	2	4
1	19	6	6	0
1	23	4	8	-4
1	26	5	7	-2
1	27	7	5	2
1	29	5	3	2
2	2	7	5	2

2	5	6	2	4
2	7	3	5	-2
2	10	6	6	0
2	12	7	5	2
2	17	3	5	-2
2	22	4	8	-4
2	30	4	4	0
3	1	4	6	-2
3	3	3	3	0
3	4	8	2	6
3	11	4	6	-2
3	15	4	6	-2
3	16	7	3	4
3	21	5	5	0
3	32	5	9	-4

The levels are ordered from “more prefer” to “less prefer” (Table 3.12). The difference between the code summations will describe that the code-sum with the high difference is the less prefer that Route will be.

Table 3.12: Design Codes for Attribute Levels

Code	**Speed limit**	**Speed camera**	**Travel time**	**Running costs**	**Fatal crashes**	**Injuries**
0	60	1	60 min or less	5% higher than now	Fewer than 10 people	Fewer than 20 people
1	80	2	61 to 120 min	10% higher than now	10 people or more	20 people or more
2	90			15% higher than now		
3	100			20% higher than now		

We add all the highest and lowest levels. The differences above the 4 are replaced with dominance levels. We observed from Table 3.10 files 25, 31 and 4 have difference of 6. We checked the consistency that there is not a choice set between the two alternatives include higher safety with the lower increase in the running costs or

opposite. Therefore, the “running costs” level of files 4 and 25 Rote A were decreased from 3 to 0 and files 31 was increased from 0 to 3 (Tables 3.13 and 3.14).

Table 3.13: Route A

Block	Profile	Speed limit	Speed camera	Travel time	Running costs	Fatal crashes	Injuries
-3	8	80	1	61 to 120 min	20% higher than now	Fewer than 10 people	20 people or more
-3	14	80	1	60 min or less	10% higher than now	Fewer than 10 people	20 people or more
-3	18	60	1	61 to 120 min	15% higher than now	Fewer than 10 people	Fewer than 20 people
-3	20	90	2	60 min or less	5% higher than now	10 people or more	20 people or more
-3	24	90	2	61 to 120 min	15% higher than now	10 people or more	20 people or more
-3	25	100	2	61 to 120 min	5% higher than now	10 people or more	Fewer than 20 people
-3	28	100	2	60 min or less	10% higher than now	10 people or more	Fewer than 20 people
-3	31	60	1	60 min or less	5% higher than now	Fewer than 10 people	Fewer than 20 people
-1	6	60	2	61 to 120 min	10% higher than now	Fewer than 10 people	20 people or more
-1	9	80	2	61 to 120 min	5% higher than now	Fewer than 10 people	Fewer than 20 people
-1	13	100	1	61 to 120 min	5% higher than now	10 people or more	20 people or more
-1	19	90	1	60 min or less	20% higher than now	10 people or more	Fewer than 20 people
-1	23	80	2	60 min or less	15% higher than now	Fewer than 10 people	Fewer than 20 people
-1	26	90	1	61 to 120 min	10% higher than now	10 people or more	Fewer than 20 people
-1	27	100	1	60 min or less	15% higher than now	10 people or more	20 people or more
-1	29	60	2	60 min or less	20% higher than now	Fewer than 10 people	20 people or more
1	2	90	1	61 to 120 min	20% higher than now	Fewer than 10 people	20 people or more
1	5	60	2	61 to 120 min	20% higher than now	10 people or more	Fewer than 20 people
1	7	100	1	60 min or less	5% higher than now	Fewer than 10 people	Fewer than 20 people
1	10	100	1	61 to 120 min	15% higher than now	Fewer than 10 people	Fewer than 20 people
1	12	80	2	61 to 120 min	15% higher than now	10 people or more	20 people or more
1	17	60	2	60 min or less	10% higher than now	10 people or more	Fewer than 20 people
1	22	90	1	60 min or less	10% higher than now	Fewer than 10 people	20 people or more
1	30	80	2	60 min or less	5% higher than now	10 people or more	20 people or more
3	1	80	1	61 to 120 min	10% higher than now	10 people or more	Fewer than 20 people
3	3	60	1	61 to 120 min	5% higher than now	10 people or more	20 people or more
3	4	100	2	60 min or less	5% higher than now	Fewer than 10 people	20 people or more
3	11	60	1	60 min or less	15% higher than now	10 people or more	20 people or more
3	15	90	2	61 to 120 min	5% higher than now	Fewer than 10 people	Fewer than 20 people
3	16	100	2	61 to 120 min	10% higher than now	Fewer than 10 people	20 people or more
3	21	80	1	60 min or less	20% higher than now	10 people or more	Fewer than 20 people
3	32	90	2	60 min or less	15% higher than now	Fewer than 10 people	Fewer than 20 people

Table 3.14: Route B

Block	Profile	Speed limit	Speed camera	Travel time	Running costs	Fatal crashes	Injuries
-3	8	90	1	61 to 120 min	5% higher than now	Fewer than 10 people	20 people or more
-3	14	90	1	60 min or less	15% higher than now	Fewer than 10 people	20 people or more
-3	18	80	1	61 to 120 min	20% higher than now	Fewer than 10 people	Fewer than 20 people
-3	20	100	2	60 min or less	10% higher than now	10 people or more	20 people or more
-3	24	100	2	61 to 120 min	20% higher than now	10 people or more	20 people or more
-3	25	60	2	61 to 120 min	5% higher than now	10 people or more	Fewer than 20 people
-3	28	60	2	60 min or less	15% higher than now	10 people or more	Fewer than 20 people
-3	31	80	1	60 min or less	10% higher than now	Fewer than 10 people	Fewer than 20 people
-1	6	80	2	61 to 120 min	15% higher than now	Fewer than 10 people	20 people or more
-1	9	90	2	61 to 120 min	10% higher than now	Fewer than 10 people	Fewer than 20 people
-1	13	60	1	61 to 120 min	10% higher than now	10 people or more	20 people or more
-1	19	100	1	60 min or less	5% higher than now	10 people or more	Fewer than 20 people
-1	23	90	2	60 min or less	20% higher than now	Fewer than 10 people	Fewer than 20 people
-1	26	100	1	61 to 120 min	15% higher than now	10 people or more	Fewer than 20 people
-1	27	60	1	60 min or less	20% higher than now	10 people or more	20 people or more
-1	29	80	2	60 min or less	5% higher than now	Fewer than 10 people	20 people or more
1	2	100	1	61 to 120 min	5% higher than now	Fewer than 10 people	20 people or more
1	5	80	2	61 to 120 min	5% higher than now	10 people or more	Fewer than 20 people
1	7	60	1	60 min or less	10% higher than now	Fewer than 10 people	Fewer than 20 people
1	10	60	1	61 to 120 min	20% higher than now	Fewer than 10 people	Fewer than 20 people
1	12	90	2	61 to 120 min	20% higher than now	10 people or more	20 people or more
1	17	80	2	60 min or less	15% higher than now	10 people or more	Fewer than 20 people
1	22	100	1	60 min or less	15% higher than now	Fewer than 10 people	20 people or more
1	30	90	2	60 min or less	10% higher than now	10 people or more	20 people or more
3	1	90	1	61 to 120 min	15% higher than now	10 people or more	Fewer than 20 people
3	3	80	1	61 to 120 min	10% higher than now	10 people or more	20 people or more
3	4	60	2	60 min or less	5% higher than now	Fewer than 10 people	20 people or more
3	11	80	1	60 min or less	20% higher than now	10 people or more	20 people or more
3	15	100	2	61 to 120 min	10% higher than now	Fewer than 10 people	Fewer than 20 people
3	16	60	2	61 to 120 min	15% higher than now	Fewer than 10 people	20 people or more
3	21	90	1	60 min or less	5% higher than now	10 people or more	Fewer than 20 people
3	32	100	2	60 min or less	20% higher than now	Fewer than 10 people	Fewer than 20 people

Finally, we define current a route option that is related to the respondent's recent trip experience was added to each choice set. If is used when the other alternatives are unattractive (Table 3.15, complete versions in the Appendix 1).

Table 3.15: Typical Choice Set Card

	Route A	Route B	Current Route
Speed camera (per lane)	1	2	
Average speed limit (km/h)	90	80	Neither route A
Travel time (min)	60 min or less	61 to 120 min	nor route B
Running costs (TL)	20% higher than now	10% higher than now	I prefer to stay
Fatal crashes (per year)	Fewer than 10 people	10 people or more	with my current
Injuries (per year)	20 people or more	Fewer than 20 people	route

Chapter 4

DEVELOPING QUESTIONNAIRE AND SURVEY ADMINISTRATION

4.1 Introduction

In order to identify and select the most appropriate attributes on which to build an uncomplicated and representative choice experiment questionnaire on road safety improvements, we reviewed the literature relating to CE studies on road environments, and safety improvement (Iragüen and rtúzar, 2004; Hojman et al., 2005; Hensher et al., 2005, 2009; Veisten et al., 2013; Haddak et al., 2014).

We organized the questionnaire into four main sections (Appendix 2): Recent trip and perception of safety; WTP for improved safety in road environment (CE questions); WTP to prevent the premature death (CVM question); and driver's characteristics. First, we present summary statistics of the pilot survey results driver's characteristics. Some changes were made in the main questionnaires after considering the feedback from the focus groups in the pilot study. The main questionnaires had an introductory letter to the respondents explaining that the aim of the study was to improve road safety in order to avoid fatalities and injuries and time saving.

4.2 Pilot Study

We interviewed with 40 respondents in February 2014. The summary statistics are reported below.

4.2.1 Socio-demographics Characteristics-Pilot Study

The average pilot survey time for fill the survey was half an hour. Out of the respondents in pilot survey 67.5% married, 52.5% male, 87.5% has job, 60% postgraduate degree, and 27.5% has an income higher than 12000 YTL/month (Table 4.1).

Table 4.1: Socio-demographics Characteristic-Pilot Survey

Q1	Where do you reside?	Responses	Percentage
	Lefkoşa	11	27.5%
	Gazimağusa	11	27.5%
	Girne	8	20%
	Güzelyurt	5	12%
	İskele	5	12%

Q2	Gender of the respondent	Responses	Percentage
	Male	21	52.5%
	Female	19	47.5%

Q3	How old are you?				
	N	Minimum	Maximum	Mean	Std. Deviation
	40	23	61	42	9.93

Q4	Marital Status	Responses	Percentage
	Single (never married)	10	25.0%
	Married	27	67.5%
	Divorced/Separated	3	7.5%
	Widowed	0	0

Q5	Do you work?	Responses	Percentage
	Yes	35	87.5%
	No	5	12.5%

Q6	What is the legal status of your work?	Responses	Percentage
	Public	23	57.5%
	Private	12	30%

Q7.1	What is your status at work?	Responses	Percentage
	Employee (Salary, wages)	30	75%
	Employer	4	10 %
	Self-employed	1	2.5 %

Q8	What is the reason for not working?	Responses	Percentage
	Retired	2	5 %
	Student	3	7.5%

	Household duties	0	0%
	Looking for a job, couldn't find one	0	0%
	Found a job, waiting to start	0	0%
	Other (please specify)	0	0%

Q9	Specify which of the following represent the total monthly income of all the members of your family (YTL) (including yourself)	Responses	Percentage
	Less than 950	0	0%
	950-1,250	0	0%
	1,251-1,500	1	2.5%
	1,501-1,750	0	0%
	1,751-2,000	2	5%
	2,001-2,250	0	0%
	2,251-2,500	1	2.5%
	2,501-2,750	1	2.5%
	2,751-3,000	3	7.5%
	3,001-3,250	3	7.5%
	3,251-3,500	3	7.5%
	3,501-4,000	1	2.5%
	4,001-4,500	1	2.5%
	4,501-5,000	5	12.5%
	5,001-7000	1	2.5%
	7001-9000	2	2.5%
	9001-12000	5	12.5%
	More than 12000	11	27.5%

Q10	Which of the following best describes the highest level of formal education you have attained/completed?	Responses	Percentage
	No formal education	0	0%
	Primary school	0	0%
	Secondary school	2	5%
	College/high school	6	15%
	Technical school	2	5%
	University (2 year)	0	0%
	University (4 year bachelor)	6	15%
	Post graduate	24	60%

4.2.2 Recent Trip and Perception of Safety-Pilot Study

The recent trip behavior of respondents is organized in Table 4.2. 75% of the respondents had used their own car. The majority of the trips were between Lefkosa and Gazimağusa, and 57.5% of respondents paid for the trip costs personally. According to respondents on average 76% of the trips were free-flow without

congestion. The majority of trips were for travelling to/from work.

Their opinion about current road safety was that 65% of the respondents was strongly disagree with the use of a cell phone while driving an automobile, 46% of them was disagree with eating while driving an automobile, 36% of respondents had a neutral feeling about being relaxed while driving and 45% of them was strongly agree with having law enforcement officials enforcing laws of the road. The majority of respondents considered the winter season as the most dangerous season to be driving on the roadways.

Table 4.3 reports the perception of safety and road policy by the respondents. 85% of the respondents agreed that the effect of the speed camera systems was to reduce speeds and save lives. The respondents 22.5% were against using speed camera to enforce speed limit laws.

Table 4.2: Recent Trip and Road Safety-Pilot Survey

Q11	Which of the following transportation systems are you used?	Responses	Percentage
	Own car	30	75%
	Someone else's car	1	2.5%
	Own car & taxi	2	5.0%
	Taxi &school bus	1	2.5%
	Own car & some else' car	4	10%
	Own car & private bus	2	5%

Q12	Where does your trip start?	Responses	Percentage
	Lefkosa	7	17.5%
	Gazimağusa	16	40%
	Girne	4	10%
	Iskele	6	15%
	Yeni bogazici	3	7.5%
	Tuzla	3	7.5%

	Outuken	1	2.5%

Q13	Where does your trip end?	Responses	Percentage
	Lefkosa	7	17.5%
	Gazimağusa	29	72.5%
	Girne	1	2.5%
	Güzelyurt	1	2.5%
	Iskele	1	2.5%
	Yeni bogazici	1	2.5%

Q14	What was your average speed limit?				
	N	Minimum	Maximum	Mean	Std. Deviation
	40	50	100	75	70

Q15	About how long did this trip take?				
	N	Minimum	Maximum	Mean	Std. Deviation
	40	00:05	01:30	00:37	00:23

Q16.1	Did your trip involve any breaks?	Responses	Percentage
	Yes	7	17.5%
	No	29	72.5%
	Sometimes	4	10%

Q16.2	How many breaks did you take?	Responses	Percentage
	0	29	72.5%
	1	4	10%
	2	7	17.5%

Q16.3	How long were the breaks in total?				
	N	Minimum	Maximum	Mean	Std. Deviation
	40	00:00	00:30	00:03	00:06

Q17	Are you or another member of your household paying for trip cost personally?	Responses	Percentage
	Yes	23	57.5%
	Partly	2	5%
	No	15	37.5%

Q18	On average how many times do you use this road in a week?				
	N	Minimum	Maximum	Mean	Std. Deviation
	40	1	30	7	7

Q19	Could you describe the percentage of time spent in the following traffic conditions?				
	N	Minimum	Maximum	Mean	Std. Deviation
Percentage of the trip is free flow	40	0	100	76	27
Percentage of the trip involves minor delays due to a build up of traffic	40	0	40	10	12
Percentage of the trip involves major delays due to a build up of traffic	40	0	86	8	16
Percentage of the trip involves major delays due to an accident	40	0	30	4	7
Percentage of the trip involves major delays due to a break down	40	0	20	4	5

Q20	What is the purpose of your trip?	Responses	Percentage
	Education	4	10%
	Personal business	1	2.5%
	Travelling for work purposes	9	22.5%
	Travelling to/from work	10	25.0%
	Visiting friends/relatives	6	15 %
	Others	1	2.5%
	Visiting friends/relatives & shopping	1	2.5%
	Visiting friends/relatives & education	1	2.5%
	Visiting friends/relatives & shopping& travelling	1	2.5%
	Visiting friends/relatives & shopping& travelling	1	2.5%
	Education, shopping and travelling from/to work	2	5%
	Visiting friends/relatives & shopping	1	2.5%
	Travelling for work purposes and shopping	2	5%

Q21	For your trip how many people in the following age groups are in the vehicle?	Responses	Percentage
	Under the 18	6	15%
	18-24	3	7.5%
	25-34	1	2.5%
	35-44	6	15%
	45-54	1	2.5%
	55-64	1	2.5%
	65 and over	1	2.5%
	Nobody	9	22.5%
	25-34& 35-44 & 45-54 & 55-64	1	2.5%
	Under the 18 & 35-44	4	10%
	18-24 & 25-34	1	2.5%
	25-34 &35-44	1	2.5%
	18-24 &45-54	2	5%
	Under the 18 & 25-34 & 45-54	2	5%
	Under the 18 & 25-34	1	2.5%

Table 4.3: Perception of Safety

Q 22. V1	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	35	87.5%	5	12.5%	40	100.0%

Q22	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	2	2.0%	5.7%
	Become sleepy while driving	15	14.9%	42.9%
	Encounter law enforcement officials enforcing laws of the road	5	5.0%	14.3%
	Feel less endangered driving after consuming alcohol	26	25.7%	74.3%
	Eat while driving an automobile	14	13.9%	40.0%
	Drive at a speed exceeding the posted speed limit	16	15.8%	45.7%
	Use a cell phone while driving an automobile	23	22.8%	65.7%
	Total	101	100%	288.6%

Q 22. V2	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	32	80.0%	8	20.0%	40	100.0%

Q22	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	11	18.0%	34.4%
	Become sleepy while driving	8	13.1%	25.0%
	Encounter law enforcement officials enforcing laws of the road	6	9.8%	18.8%
	Feel less endangered driving after consuming alcohol	4	6.6%	12.5%
	Eat while driving an automobile	15	24.6%	46.9%
	Drive at a speed exceeding the posted speed limit	9	14.8%	28.1%
	Use a cell phone while driving an automobile	8	13.1%	25.0%
	Total	61	100.0%	190.6%

Q 22.V3	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	22	55.0%	18	45.0%	40	100.0%

Q22	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	8	18.6%	36.4%
	Become sleepy while driving	6	14.0%	27.3%

	Encounter law enforcement officials enforcing laws of the road	8	18.6%	36.4%
	Feel less endangered driving after consuming alcohol	4	9.3%	18.2%
	Eat while driving an automobile	6	14.0%	27.3%
	Drive at a speed exceeding the posted speed limit	7	16.3%	31.8%
	Use a cell phone while driving an automobile	4	9.3%	18.2%
	Total	43	100.0%	195.5%

Q 22. V4	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	31	77.5%	9	22.5%	40	100.0%

Q22	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	13	22.8%	41.9%
	Become sleepy while driving	9	15.8%	29.0%
	Encounter law enforcement officials enforcing laws of the road	14	24.6%	45.2%
	Feel less endangered driving after consuming alcohol	5	8.8%	16.1%
	Eat while driving an automobile	5	8.8%	16.1%
	Drive at a speed exceeding the posted speed limit	7	12.3%	22.6%
	Use a cell phone while driving an automobile	4	7.0%	12.9%
	Total	57	100.0%	183.9%

Q 22. V5	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	16	40.0%	24	60.0%	40	100.0%

Q22	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	6	33.3%	37.5%
	Become sleepy while driving	2	11.1%	12.5%
	Encounter law enforcement officials enforcing laws of the road	7	38.9%	43.8%
	Feel less endangered driving after consuming alcohol	1	5.6%	6.3%
	Eat while driving an automobile	0	0	0
	Drive at a speed exceeding the posted speed limit	1	5.6%	6.3%
	Use a cell phone while driving an automobile	1	5.6%	6.3%
	Total	18	100.0%	112.5%

Q23	Which one season do you consider to be the most dangerous season to be driving on the roadways?	Responses	Percentage
	Spring	1	2.5%
	Summer	5	12.5%
	Fall	1	2.5%
	Winter	33	82.5%

Q 24. V1	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	36	90.0%	4	10.0%	40	100.0%

Q24	The following nine statements related to your perceptions of safety rules and regulations.	Responses		Percentage of case
	Many safety rules must be ignored to ensure traffic flow	32	18.7%	88.9%
	Sometimes it is necessary to bend the rule to ensure traffic flow	13	7.6%	36.1%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	14	8.2%	38.9%
	It is acceptable to speed when the other people are not involve	19	11.1%	52.8%
	It is acceptable to take chances when you are the only one exposed to the risk	21	12.3%	58.3%
	Safety rules are often complicated to be carried out in real life	12	7.0%	33.3%
	It is acceptable to break safety rules during the transport of people	25	14.6%	69.4%
	It is acceptable to break safety rules during the transport of goods	27	15.8%	75.0%
	It is more important to contribute to traffic condition than to always obey the laws	8	4.7%	22.2%
	Total	171	100.0	475.0%

Q 24. V2	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	30	75.0%	10	25.0%	40	100.0%

Q24	The following nine statements related to your perceptions of safety rules and regulations.	Responses		Percentage of case
	Many safety rules must be ignored to ensure traffic flow	5	6.0%	16.7%
	Sometimes it is necessary to bend the rule to ensure traffic flow	11	13.1%	36.7%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	7	8.3%	23.3%
	It is acceptable to speed when the other people are not involve	9	10.7%	30.0%
	It is acceptable to take chances when you are the only one exposed to the risk	13	15.5%	43.3%
	Safety rules are often complicated to be carried out in real life	13	15.5%	43.3%
	It is acceptable to break safety rules during the transport of people	7	8.3%	23.3%

	It is acceptable to break safety rules during the transport of goods	8	9.5%	26.7%
	It is more important to contribute to traffic condition than to always obey the laws	11	13.1%	36.7%
	Total	84	100.0	280.0%

Q 24.V3	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	31	77.5%	9	22.5%	40	100.0%

Q24	The following nine statements related to your perceptions of safety rules and regulations.	Responses	Percentage of case	
	Many safety rules must be ignored to ensure traffic flow	1	1.5%	3.2%
	Sometimes it is necessary to bend the rule to ensure traffic flow	12	18.2%	38.7%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	13	19.7%	41.9%
	It is acceptable to speed when the other people are not involve	10	15.2%	32.3%
	It is acceptable to take chances when you are the only one exposed to the risk	5	7.6%	16.1%
	Safety rules are often complicated to be carried out in real life	9	13.6%	29.0%
	It is acceptable to break safety rules during the transport of people	2	3.0%	6.5%
	It is acceptable to break safety rules during the transport of goods	2	3.0%	6.5%
	It is more important to contribute to traffic condition than to always obey the laws	12	18.2%	38.7%
	Total	66	100.0%	212.9%

Q 24. V4	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	15	37.5%	25	62.5%	40	100.0%

Q24	The following nine statements related to your perceptions of safety rules and regulations.	Responses		Percentage of case
	Many safety rules must be ignored to ensure traffic flow	0	0	0
	Sometimes it is necessary to bend the rule to ensure traffic flow	4	15.4%	26.7%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	3	11.5%	20.0%

	It is acceptable to speed when the other people are not involve	1	3.8%	6.7%
	It is acceptable to take chances when you are the only one exposed to the risk	1	3.8%	6.7%
	Safety rules are often complicated to be carried out in real life	3	11.5%	20.0%
	It is acceptable to break safety rules during the transport of people	4	15.4%	26.7%
	It is acceptable to break safety rules during the transport of goods	3	11.5%	20.0%
	It is more important to contribute to traffic condition than to always obey the laws	7	26.9%	46.7%
	Total	26	100.0%	173.3%

Q 24. V5	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	11	27.5%	29	72.5%	40	100.0%

Q24	The following nine statements related to your perceptions of safety rules and regulations.	Responses		Percentage of case
	Many safety rules must be ignored to ensure traffic flow	2	15.4%	18.2%
	Sometimes it is necessary to bend the rule to ensure traffic flow	0	0	0
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	3	23.1%	27.3%
	It is acceptable to speed when the other people are not involve	1	7.7%	9.1%
	It is acceptable to take chances when you are the only one exposed to the risk	0	0	0
	Safety rules are often complicated to be carried out in real life	3	23.1%	27.3%
	It is acceptable to break safety rules during the transport of people	2	15.4%	18.2%
	It is acceptable to break safety rules during the transport of goods	0	0	0
	It is more important to contribute to traffic condition than to always obey the laws	2	15.4%	18.2%
	Total	13	100.0%	118.2%

Q 25. V1	The following statements related to ideas being discussed as possible ways to make roads safer.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safer	8	20.0%	32	80.0%	40	100.0%

Q25	The following statements related to ideas being discussed as possible ways to make roads safer.	Responses		Percentage of case
	Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws	4	21.1%	50.0%
	Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk	3	15.8%	37.5%
	Requiring motorcyclists to wear a helmet	3	15.8%	37.5%
	Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license	2	10.5%	25.0%
	Enforcing speed limit laws through the use of speed camera	4	21.1%	50.0%
	Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring	3	15.8%	37.5%
	Total	19	100.0%	237.5%

Q 25. V2	The following statements related to ideas being discussed as possible ways to make roads safer.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safer	13	32.5%	27	67.5%	40	100.0%

Q25	The following statements related to ideas being discussed as possible ways to make roads safer.	Responses		Percentage of case
	Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws	1	5.6%	7.7%
	Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk	1	5.6%	7.7%
	Requiring motorcyclists to wear a helmet	1	5.6%	7.7%
	Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license	4	22.2%	30.8%
	Enforcing speed limit laws through the use of speed camera	3	16.7%	23.1%
	Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring	8	44.4%	61.5%
	Total	18	100.0	138.5%

Q 25.V3	The following statements related to ideas being discussed as possible ways to make roads safer.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safer	27	67.5%	13	32.5%	40	100.0%

Q25	The following statements related to ideas being discussed as possible ways to make roads safer.	Responses	Percentage of case

	Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws	15	22.7%	55.6%
	Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk	9	13.6%	33.3%
	Requiring motorcyclists to wear a helmet	4	6.1%	14.8%
	Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license	11	16.7%	40.7%
	Enforcing speed limit laws through the use of speed camera	11	16.7%	40.7%
	Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring	16	24.2%	59.3%
	Total	66	100.0%	244.4%

Q 25. V4	The following statements related to ideas being discussed as possible ways to make roads safer.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safer	36	90.0%	4	10.0%	40	100.0%

Q25	The following statements related to ideas being discussed as possible ways to make roads safer.	Responses		Percentage of case
	Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws	20	14.9%	55.6%
	Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk	26	19.4%	72.2%
	Requiring motorcyclists to wear a helmet	31	23.1%	86.1%
	Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license	22	16.4%	61.1%
	Enforcing speed limit laws through the use of speed camera	22	16.4%	61.1%
	Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring	13	9.7%	36.1%
	Total	134	100.0%	372.2%

Q 26. V1	The following statements related to speed cameras in enforcing speed limit laws.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Speed camera	14	35.0%	26	65.0%	40	100.0%

Q26	The following statements related to speed cameras in enforcing speed limit laws.	Responses		Percentage of case
	These systems would reduce speeds and save lives	0	0	0
	These systems would cost less than human enforcement	0	0	0
	These systems would free law enforcement officials to prevent crimes and catch criminals	3	15.8%	21.4%

	These systems would be extremely accurate identifying speeders	3	15.8%	21.4%
	No one has to worry about tickets if they simply obey the law	2	10.5%	14.3%
	Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed	2	10.5%	14.3%
	An independent company would monitor the system to ensure the government is not misusing the data being gathered	9	47.4%	64.3%
	Total	19	100.0%	135.7%

Q 26. V2	The following statements related to speed cameras in enforcing speed limit laws.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Speed camera	23	57.5%	17	42.5%	40	100.0%

Q26	The following statements related to speed cameras in enforcing speed limit laws.	Responses		Percentage of case
	These systems would reduce speeds and save lives	4	8.2%	17.4%
	These systems would cost less than human enforcement	6	12.2%	26.1%
	These systems would free law enforcement officials to prevent crimes and catch criminals	7	14.3%	30.4%
	These systems would be extremely accurate identifying speeders	7	14.3%	30.4%
	No one has to worry about tickets if they simply obey the law	5	10.2%	21.7%
	Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed	8	16.3%	34.8%
	An independent company would monitor the system to ensure the government is not misusing the data being gathered	12	24.5%	52.2%
	Total	49	100.0%	213.0%

Q 26.V3	The following statements related to speed cameras in enforcing speed limit laws.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Speed camera	37	92.5%	3	7.5%	40	100.0%

Q26	The following statements related to speed cameras in enforcing speed limit laws.	Responses		Percentage of case
	These systems would reduce speeds and save lives	17	13.5%	45.9%
	These systems would cost less than human enforcement	21	16.7%	56.8%
	These systems would free law enforcement officials to prevent crimes and catch criminals	19	15.1%	51.4%
	These systems would be extremely accurate identifying speeders	18	14.3%	48.6%
	No one has to worry about tickets if they simply obey the law	18	14.3%	48.6%

	Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed	19	15.1%	51.4%
	An independent company would monitor the system to ensure the government is not misusing the data being gathered	14	11.1%	37.8%
	Total	126	100.0%	340.5%

Q 26. V4	The following statements related to speed cameras in enforcing speed limit laws.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Speed camera	34	85.0%	6	15.0%	40	100.0%

Q26	The following statements related to speed cameras in enforcing speed limit laws.	Responses		Percentage of case
	These systems would reduce speeds and save lives	19	22.1%	55.9%
	These systems would cost less than human enforcement	13	15.1%	38.2%
	These systems would free law enforcement officials to prevent crimes and catch criminals	11	12.8%	32.4%
	These systems would be extremely accurate identifying speeders	12	14.0%	35.3%
	No one has to worry about tickets if they simply obey the law	15	17.4%	44.1%
	Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed	11	12.8%	32.4%
	An independent company would monitor the system to ensure the government is not misusing the data being gathered	5	5.8%	14.7%
	Total	86	100.0%	252.9%

Q 27. V1	The following statements against using speed cameras in enforcing speed limit laws					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Against camera	28	70.0%	12	30.0%	40	100.0%

Q27	The following statements against using speed cameras in enforcing speed limit laws	Responses		Percentage of case
	The government would invade privacy with the information they could gather	11	11.8%	39.3%
	These systems have made errors, so people would be treated unfairly	14	15.1%	50.0%
	It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers	18	19.4%	64.3%
	No one knows if these systems would actually save lives	10	10.8%	35.7%
	Drivers would find ways to evade the camera systems and avoid the law	7	7.5%	25.0%
	It would cost too many tax to buy, install and maintain all of the cameras	10	10.8%	35.7%
	Local government officials cannot be trusted to run this system well	8	8.6%	28.6%

	Using this system would take jobs away from hard-working law enforcement officials	15	16.1%	53.6%
	Total	93	100.0%	332.1%

Q 27. V2	The following statements against using speed cameras in enforcing speed limit laws					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Against camera	33	82.5%	7	17.5%	40	100.0%

Q27	The following statements against using speed cameras in enforcing speed limit laws	Responses		Percentage of case
	The government would invade privacy with the information they could gather	10	9.1%	30.3%
	These systems have made errors, so people would be treated unfairly	9	8.2%	27.3%
	It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers	11	10.0%	33.3%
	No one knows if these systems would actually save lives	17	15.5%	51.5%
	Drivers would find ways to evade the camera systems and avoid the law	17	15.5%	51.5%
	It would cost too many tax to buy, install and maintain all of the cameras	21	19.1%	63.6%
	Local government officials cannot be trusted to run this system well	14	12.7%	42.4%
	Using this system would take jobs away from hard-working law enforcement officials	11	10.0%	33.3%
	Total	110	100.0%	333.3%

Q 27.V3	The following statements against using speed cameras in enforcing speed limit laws					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Against camera	30	75.0%	10	25.0%	40	100.0%

Q27	The following statements against using speed cameras in enforcing speed limit laws	Responses		Percentage of case
	The government would invade privacy with the information they could gather	16	15.7%	53.3%
	These systems have made errors, so people would be treated unfairly	16	15.7%	53.3%
	It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers	9	8.8%	30.0%
	No one knows if these systems would actually save lives	12	11.8%	40.0%
	Drivers would find ways to evade the camera systems and avoid the law	14	13.7%	46.7%
	It would cost too many tax to buy, install and maintain all of the cameras	8	7.8%	26.7%

	Local government officials cannot be trusted to run this system well	15	14.7%	50.0%
	Using this system would take jobs away from hard-working law enforcement officials	12	11.8%	40.0%
	Total	102	100.0%	340.0%

Q 27. V4	The following statements against using speed cameras in enforcing speed limit laws					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Against camera	9	22.5%	31	77.5%	40	100.0%

Q27	The following statements against using speed cameras in enforcing speed limit laws	Responses		Percentage of case
	The government would invade privacy with the information they could gather	3	20.0%	33.3%
	These systems have made errors, so people would be treated unfairly	1	6.7%	11.1%
	It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers	2	13.3%	22.2%
	No one knows if these systems would actually save lives	1	6.7%	11.1%
	Drivers would find ways to evade the camera systems and avoid the law	2	13.3%	22.2%
	It would cost too many tax to buy, install and maintain all of the cameras	1	6.7%	11.1%
	Local government officials cannot be trusted to run this system well	3	20.0%	33.3%
	Using this system would take jobs away from hard-working law enforcement officials	2	13.3%	22.2%
	Total	15	100.0%	166.7%

4.2.3 Choice Experiment Model-Pilot Study

Table 4.4 reports the preferences of the respondents for choosing the new route based on personal or relatives experiences in traffic incidents.

Table 4.4: Preference for Improved Road-Pilot Survey

Q28.a	Assume that you have to drive somewhere and that you can take two different routes. Which routes would you use?	Responses	Percentage
	Route A	20	50%
	Route B	20	50%

Q28.b	If you could also chose not to travel:	Responses	Percentage
	I would stick with the same route	37	92.5%
	I would choose not to travel	3	7.5%

Q28	Did you take into the account the implications of your choice on the safety of others not to travelling with	Responses	Percentage
	1	5	12.5%
	2	1	2.5%
	3	9	22.5%
	4	4	10%
	5	6	15%
	6	5	12.5%
	7	5	12.5%
	8	2	5%
	9	1	2.5%
	10	2	5%

Q 29. V1	Have you ever been in car accident in which someone…….					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Car accident	14	35.0%	26	65.0%	40	100.0%

Q29	Have you ever been in car accident in which someone…….	Responses		Percentage of case
	Was severely injured and has a permanent disability?	2	11.1%	14.3%
	Was hospitalized?	3	16.7%	21.4%
	Received minor injuries not requiring hospitalization?	13	72.2%	92.9%
	Total	18	100.0	128.6%

Q 29. V2	Have you ever been in car accident in which someone…….					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Car accident	40	100.0%	0	.0%	40	100.0%

Q29	Have you ever been in car accident in which someone…….	Responses		Percentage of case
	Was severely injured and has a permanent disability?	38	37.3%	95.0%
	Was hospitalized?	37	36.3%	92.5%
	Received minor injuries not requiring hospitalization?	27	26.5%	67.5%
	Total	102	100.0	255.0%

Q 30. V1	Have anyone close to you ever been involved in a car accident in which someone:					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Car accident	20	50.0%	20	50.0%	40	100.0%

Q30	Have anyone close to you ever been involved in a car accident in which someone:	Responses		Percentage of case
	Died?	5	12.5%	25.0%
	Was severely injured and has a permanent disability?	3	7.5%	15.0%
	Was hospitalized?	13	32.5%	65.0%
	Received minor injuries not requiring	19	47.5%	95.0%
	Total	40	100.0	200.0%

Q 30. V2	Have anyone close to you ever been involved in a car accident in which someone:					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Car accident	39	97.5%	1	2.5%	40	100.0%

Q30	Have anyone close to you ever been involved in a car accident in which someone:	Responses		Percentage of case
	Died?	35	29.2%	89.7%
	Was severely injured and has a permanent disability?	37	30.8%	94.9%
	Was hospitalized?	27	22.5%	69.2%
	Received minor injuries not requiring	21	17.5%	53.8%
	Total	120	100.0	307.7%

4.3 The Revised Questionnaire

Some changes were made in the final questionnaires according to the pilot study results and respondents recommendations (Appendix 3).

Section 1

Residency of abroad from question 1 and year of birth from question 3 in Section 1 were removed. The minimum wage per month was changed to 1300. The socio-demographics questions are transferred to the end of survey.

Section 2

We added more age groups to question 21. Also, the respondents can choose one or more of the alternatives in questions 11 and 20. We removed questions 24 and 25 since they were found to be confusing. The table in the perception of safety was organized to the most simple and appropriate questions.

Section 3

This section was too complicated therefore we added introductory letter to the respondents explaining that the main object of this study is road safety improvement in order to avoid fatalities and injuries. The attributes in the choice sets section were also explained, and respondents were advised to consider each choice set as an independent decision. Also, in question 26 tolls was removed as part of running costs since it is not include in the travel cost in North Cyprus.

4.4 Final Survey

4.4.1 Survey Sampling Techniques

In this study the CE focuses on the preferences of Turkish-Cypriot drivers. We considered the three different sample techniques for selecting the sample population. They are namely choice-based sampling (CBS) which is used widely in collecting revealed preference data, simple random sampling (SRS) which gives the equal probability to each individual to be included in the sample, and exogenous stratified random sampling (ESRS). In this case the respondent would be is categorized into G mutually exclusive groups with random sampling (Louviere et al., 2000).

We will choose the ESRS method with five mutually exclusive groups based on the main districts in North Cyprus. Of the 286,257 populations in North Cyprus (2012 Census), 33.1% were from Lefkoşa, 24.4% were from Gazimağusa, 24.2% were

from Girne, 10.5% were from Güzelyurt, and 7.9% were from İskele (Table 4.6). [8]

Table 4.6: Number of Respondents

District	Number of individuals	% Of Total	Targeted Number of Interviews
Lefkosa	97,824	33.1	132
Gazimagusa	69,41	24.4	94
Girne	69,163	24.2	93
Güzelyurt	30,037	10.5	40
Iskele	22,492	7.9	30
Total	286,257		389

4.4.2 Interview Format

We chose face-to-face (or in-person) interview among the most commonly used interview formats (Hensher et al., 2005).

1. Face to face format is the one of the most popular formats to collect the data in North Cyprus and the people are familiar with it.

2. Questionnaire is complicate in the CE section; we need to give enough information and explanation to respondents.

3. To prevent hypothetical bias the questionnaire should be answered in order (Arrow et al. 1993).

4. We allow the presentation of enough information in a controlled sequence whilst increase the respondent interest and attention to carefully consider their response.

[8] In sample size equation when n= 389, p=0.5 at 95% confidence interval, gives a=5.31%.

$$n \geq \frac{(1-p)}{rpa^2}\left[\Phi^{-1}\left(1-\frac{\alpha}{2}\right)\right]^2$$

4.5 Summary Statistics of result

4.5.1 Data Entry

Table 4.7 presents the data coding used in data entry in MS Excel.

Table 4.7: Coding of Data

Column	**Code**
Id	Whole number 1-389
Q1	Whole number 1- 8
Q2, Q3, Q4, Q5, Q6.2, Q6.3, Q7.2, Q8, Q26	Continuous number
Q9.1- Q9.5	Continuous number 1-100
Q7.1	1: yes 2: partly 3: no
Q10, Q11, Q33	Whole number 1- 8
Q12, Q14.1- Q14.9, Q24	Whole number 1- 5
Q13, Q15, Q16, Q17, Q27	Whole number 1- 4
Q18.1	1: Route A 2: Route B 3: Current Route
Q18.2	1: Same route 2: Not to travel
Q19	Whole number 1- 10
Q6.1, Q20.1-Q20.3, Q21.1-Q21.4, Q28	1: yes 2: no
Q22.1	Whole number 1- 16
Q22.2	1: very sure 2: reasonably certain 3: not very sure
Q23	Open-end
Q25	1: Male 2: Female
Q29	1: Public 2: Private
Q30	1: Employee 2:Employer 3: self-employed
Q31	Whole number 1- 6
Q32	Whole number 1- 15

4.5.2 Socio-demographics Characteristic

Table 4.8: Socio-demographics Characteristic

Q24	Where do you reside?	Responses	Percentage
	Lefkoşa	132	23.9%
	Gazimağusa	94	24.2%
	Girne	93	23.9%
	Güzelyurt	40	10.3%
	İskele	30	7.7%
	Total	398	100%

Q25	Gender of the respondent	Responses	Percentage
	Male	235	60.4%
	Female	154	39.6%

Q26	How old are you?				
	N	Minimum	Maximum	Mean	Std. Deviation
	389	20	61	36.74	10.62

Q27	Marital Status	Responses	Percentage
	Single (never married)	170	43.7%
	Married	197	50.6%
	Divorced/Separated	22	5.7%
	Widowed	0	0

Q28	Do you work?	Responses	Percentage
	Yes	251	64.5%
	No	138	35.5%

Q29	What is the legal status of your work?	Responses	Percentage
	Public	178	68.48%
	Private	81	31.51%

Q30	What is your status at work?	Responses	Percentage
	Employee (Salary, wages)	229	89.1%
	Employer	16	6.2 %
	Self-employed	12	4.6 %

Q31	What is the reason for not working?	Responses	Percentage
	Retired	9	6.82 %
	Student	105	79.54%
	Household duties	18	13.64%
	Looking for a job, couldn't find one	0	0%
	Found a job, waiting to start	0	0%
	Other (please specify)	0	0%

Q32	Specify which of the following represent the total monthly income of all the members of your family (YTL) (including yourself)	Responses	Percentage
	Less than 950	9	2.3%
	950-1,250	14	3.6%

	1,251-1,500	12	3.1%
	1,501-1,750	13	3.3%
	1,751-2,000	12	3.1%
	2,001-2,250	6	1.5%
	2,251-2,500	9	2.3%
	2,501-2,750	19	4.9%
	2,751-3,000	14	3.6%
	3,001-3,250	13	3.3%
	3,251-3,500	4	1.0%
	3,501-4,000	12	3.1%
	4,001-4,500	28	7.2%
	4,501-5,000	22	5.7%
	5,001-7000	33	8.5%
	7001-9000	67	17.2%
	9001-12000	102	26.2%
	More than 12000	9	2.3%

Q33	Which of the following best describes the highest level of formal education you have attained/completed?	Responses	Percentage
	No formal education	3	0.8%
	Primary school	9	2.3%
	Secondary school	19	4.9%
	College/high school	63	16.2%
	Technical school	22	5.7%
	University (2 year)	27	6.9%
	University (4 year bachelor)	102	26.2%
Q1	Post graduate	144	37%

4.5.3 Recent Trip and Perception of Safety

Table 4.9: Recent Trip and Road Safety

Q2	Where does your trip start?	Responses	Percentage
	Lefkosa	126	32.4%
	Gazimağusa	81	20.8%
	Girne	88	22.6%
	Güzelyurt	40	10.3%
	Iskele	35	9%
	Yeni bogazici	11	2.8%
	Tuzla	5	1.3%
	Karpaz	3	0.9%

Q3	Where does your trip end?	Responses	Percentage
	Lefkosa	109	28%
	Gazimağusa	138	35.5%
	Girne	59	15.2%
	Güzelyurt	34	8.7%
	Iskele	19	4.9%
	Yeni bogazici	3	0.8%
	Bogaz	27	6.9%

Q4	What was your average speed limit?				
	N	Minimum	Maximum	Mean	Std. Deviation
	389	50	100	80	76

Q5	About how long did this trip take?				
	N	Minimum	Maximum	Mean	Std. Deviation
	389	00:15	02:00	00:54	00:22

Q6.1	Did your trip involve any breaks?	Responses	Percentage
	Yes	85	21.9%
	No	304	78.1%

Q6.2	How many breaks did you take?	Responses	Percentage
	1.00	38	44.7%
	2.00	35	41.17%
	3.00	3	3.52%
	4.00	3	3.52%
	5.00	3	3.52%
	10.00	3	3.52%

Q6.3	How long were the breaks in total?				
	N	Minimum	Maximum	Mean	Std. Deviation
	85	00:00	10:00	00:09	00:53

Q7	Are you or another member of your household paying for trip cost personally?	Responses	Percentage
	Yes	215	55.3%
	Partly	55	14.1%
	No	119	30.6%

Q8	On average how many times do you use this road in a week?				
	N	Minimum	Maximum	Mean	Std. Deviation
	389	1.00	15.00	59.717	358.932

Q9	Could you describe the percentage of time spent in the following traffic conditions?				
	N	Minimum	Maximum	Mean	Std. Deviation
Percentage of the trip is free flow	389	.00	100.00	80.94	22.87.
Percentage of the trip involves minor delays due to a build up of traffic	389	.00	50.00	6.97	10.15
Percentage of the trip involves major delays due to a build up of traffic	389	.00	86.00	5.36	10.97.
Percentage of the trip involves major delays due to an accident	389	.00	30.00	4.15	6.02
Percentage of the trip involves major delays due to a break down	389	.00	30.00	2.55	5.09

Q10	What is the purpose of your trip?	Responses	Percentage
	Education	4	10%
	Personal business	1	2.5%
	Travelling for work purposes	9	22.5%
	Travelling to/from work	10	25.0%
	Visiting friends/relatives	6	15 %
	Others	1	2.5%
	Visiting friends/relatives & shopping	1	2.5%
	Visiting friends/relatives & education	1	2.5%
	Visiting friends/relatives & shopping& travelling	1	2.5%
	Visiting friends/relatives & shopping& travelling	1	2.5%
	Education, shopping and travelling from/to work	2	5%
	Visiting friends/relatives & shopping	1	2.5%
	Travelling for work purposes and shopping	2	5%

Q11	For your trip how many people in the following age groups are in the vehicle?	Responses	Percentage
	Under the 18	41	10.5%
	18-24	42	10.8%
	25-34	45	11.6%
	35-44	49	12.6%
	45-54	13	3.3%
	55-64	12	3.1%
	65 and over	4	1%
	Nobody	109	28%
	25-34, 35-44, 45-54 and 55-64	4	1%
	Under the 18 and 35-44	22	5.7%
	18-24 and 25-34	9	2.3%
	25-34 and 35-44	9	2.3%
	18-24 and 45-54	6	1.5%
	18-24 and 55-64	6	1.5%
	Under the 18 and 25-34	9	2.3%
	18-24 and 65 and over	3	0.8%
	25-34 and 45-54	3	0.8%
	45-54 and 55-64	3	0.8%

Table 4.10: Perception of safety

Q 12. V1	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	331	85.1%	58	14.9%	389	100.0%

Q12	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	24	2.6%	7.3%
	Become sleepy while driving	106	11.5%	32.0%
	Encounter law enforcement officials enforcing laws of the road	37	4.0%	11.2%
	Feel less endangered driving after consuming alcohol	252	27.3%	76.1%
	Eat while driving an automobile	179	19.4%	54.1%
	Drive at a speed exceeding the posted speed limit	175	19.0%	52.9%
	Use a cell phone while driving an automobile	150	16.3%	45.3%
	Total	923	100.0%	278.9%

Q 12. V2	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	281	72.2%	108	27.8%	389	100.0%

Q12	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	55	9.9%	19.6%
	Become sleepy while driving	64	11.5%	22.8%
	Encounter law enforcement officials enforcing laws of the road	63	11.3%	22.4%
	Feel less endangered driving after consuming alcohol	57	10.2%	20.3%
	Eat while driving an automobile	91	16.3%	32.4%
	Drive at a speed exceeding the posted speed limit	95	17.1%	33.8%
	Use a cell phone while driving an automobile	132	23.7%	47.0%
	Total	557	100.0%	198.2%

Q 12.V3	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	272	69.9%	117	30.1%	389	100.0%

Q12	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	61	11.5%	22.4%

	Become sleepy while driving	79	14.9%	29.0%
	Encounter law enforcement officials enforcing laws of the road	144	27.2%	52.9%
	Feel less endangered driving after consuming alcohol	40	7.6%	14.7%
	Eat while driving an automobile	71	13.4%	26.1%
	Drive at a speed exceeding the posted speed limit	64	12.1%	23.5%
	Use a cell phone while driving an automobile	70	13.2%	25.7%
	Total	529	100.0%	194.5%

Q 12. V4	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	264	67.9%	125	32.1%	389	100.0%

Q12	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	159	31.5%	60.2%
	Become sleepy while driving	90	17.9%	34.1%
	Encounter law enforcement officials enforcing laws of the road	102	20.2%	38.6%
	Feel less endangered driving after consuming alcohol	34	6.7%	12.9%
	Eat while driving an automobile	39	7.7%	14.8%
	Drive at a speed exceeding the posted speed limit	46	9.1%	17.4%
	Use a cell phone while driving an automobile	34	6.7%	12.9%
	Total	504	100.0%	190.9%

Q 12. V5	What is your opinion on the following matters on the roadways?					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safety	162	41.6%	227	58.4%	389	100.0%

Q12	What is your opinion on the following matters on the roadways?	Responses		Percentage of case
	Feel relaxed while driving	90	42.9%	55.6%
	Become sleepy while driving	50	23.8%	30.9%
	Encounter law enforcement officials enforcing laws of the road	43	20.5%	26.5%
	Feel less endangered driving after consuming alcohol	6	2.9%	3.7%
	Eat while driving an automobile	9	4.3%	5.6%
	Drive at a speed exceeding the posted speed limit	9	4.3%	5.6%
	Use a cell phone while driving an automobile	3	1.4%	1.9%
	Total	210	100.0%	129.6%

Q13	Which one season do you consider to be the most dangerous season to be driving on the roadways?	Responses	Percentage
	Spring	18	4.6%
	Summer	35	9.0%
	Fall	33	8.5%
	Winter	303	77.9

Q 14. V1	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	326	83.8%	63	16.2%	389	100.0%

Q14	The following nine statements related to your perceptions of safety rules and regulations.	Responses		Percentage of case
	Many safety rules must be ignored to ensure traffic flow	235	15.5%	72.1%
	Sometimes it is necessary to bend the rule to ensure traffic flow	133	8.8%	40.8%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	121	8.0%	37.1%
	It is acceptable to speed when the other people are not involve	148	9.8%	45.4%
	It is acceptable to take chances when you are the only one exposed to the risk	157	10.4%	48.2%
	Safety rules are often complicated to be carried out in real life	153	10.1%	46.9%
	It is acceptable to break safety rules during the transport of people	218	14.4%	66.9%
	It is acceptable to break safety rules during the transport of goods	231	15.3%	70.9%
	It is more important to contribute to traffic condition than to always obey the laws	118	7.8%	36.2%
	Total	1514	100.0	464.4%

Q 14. V2	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	291	74.8%	98	25.2%	389	100.0%

Q14	The following nine statements related to your perceptions of safety rules and regulations.	Responses		Percentage of case
	Many safety rules must be ignored to ensure traffic flow	73	7.6%	25.1%
	Sometimes it is necessary to bend the rule to ensure traffic flow	116	12.1%	39.9%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	103	10.8%	35.4%

	It is acceptable to speed when the other people are not involve	127	13.3%	43.6%
	It is acceptable to take chances when you are the only one exposed to the risk	135	14.1%	46.4%
	Safety rules are often complicated to be carried out in real life	115	12.0%	39.5%
	It is acceptable to break safety rules during the transport of people	90	9.4%	30.9%
	It is acceptable to break safety rules during the transport of goods	91	9.5%	31.3%
	It is more important to contribute to traffic condition than to always obey the laws	107	11.2%	36.8%
	Total	957	100.0	328.9%

Q 14.V3	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	288	74.0%	101	26.0%	389	100.0%

Q14	The following nine statements related to your perceptions of safety rules and regulations.	Responses	Percentage of case	
	Many safety rules must be ignored to ensure traffic flow	51	7.3%	17.7%
	Sometimes it is necessary to bend the rule to ensure traffic flow	102	14.7%	35.4%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	115	16.6%	39.9%
	It is acceptable to speed when the other people are not involve	90	13.0%	31.2%
	It is acceptable to take chances when you are the only one exposed to the risk	64	9.2%	22.2%
	Safety rules are often complicated to be carried out in real life	75	10.8%	26.0%
	It is acceptable to break safety rules during the transport of people	45	6.5%	15.6%
	It is acceptable to break safety rules during the transport of goods	43	6.2%	14.9%
	It is more important to contribute to traffic condition than to always obey the laws	109	15.7%	37.8%
	Total	694	100.0%	241.0%

Q 14. V4	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	111	28.5%	278	71.5%	389	100.0%

Q14	The following nine statements related to your perceptions of safety rules and regulations.	Responses		Percentage of case
	Many safety rules must be ignored to ensure traffic flow	6	2.9%	5.4%
	Sometimes it is necessary to bend the rule to ensure traffic flow	32	15.6%	28.8%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	21	10.2%	18.9%
	It is acceptable to speed when the other people are not involve	12	5.9%	10.8%
	It is acceptable to take chances when you are the only one exposed to the risk	21	10.2%	18.9%
	Safety rules are often complicated to be carried out in real life	31	15.1%	27.9%
	It is acceptable to break safety rules during the transport of people	24	11.7%	21.6%
	It is acceptable to break safety rules during the transport of goods	15	7.3%	13.5%
	It is more important to contribute to traffic condition than to always obey the laws	43	21.0%	38.7%
	Total	205	100.0%	184.7%

Q 14. V5	The following nine statements related to your perceptions of safety rules and regulations.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road rules	80	20.6%	309	79.4%	389	100.0%

Q14	The following nine statements related to your perceptions of safety rules and regulations.	Responses		Percentage of case
	Many safety rules must be ignored to ensure traffic flow	24	18.3%	30.0%
	Sometimes it is necessary to bend the rule to ensure traffic flow	6	4.6%	7.5%
	Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.	29	22.1%	36.2%
	It is acceptable to speed when the other people are not involve	12	9.2%	15.0%
	It is acceptable to take chances when you are the only one exposed to the risk	12	9.2%	15.0%
	Safety rules are often complicated to be carried out in real life	15	11.5%	18.8%
	It is acceptable to break safety rules during the transport of people	12	9.2%	15.0%
	It is acceptable to break safety rules during the transport of goods	9	6.9%	11.2%
	It is more important to contribute to traffic condition than to always obey the laws	12	9.2%	15.0%

	Total	131	100.0%	163.8%

Q 15. V1	The following statements related to ideas being discussed as possible ways to make roads safer.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safer	86	22.1%	303	77.9%	389	100.0%

Q15	The following statements related to ideas being discussed as possible ways to make roads safer.	Responses		Percentage of case
	Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws	25	18.1%	29.1%
	Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk	19	13.8%	22.1%
	Requiring motorcyclists to wear a helmet	12	8.7%	14.0%
	Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license	15	10.9%	17.4%
	Enforcing speed limit laws through the use of speed camera	16	11.6%	18.6%
	Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring	51	37.0%	59.3%
	Total	138	100.0%	160.5%

Q 15. V2	The following statements related to ideas being discussed as possible ways to make roads safer.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safer	176	45.2%	213	54.8%	389	100.0%

Q15	The following statements related to ideas being discussed as possible ways to make roads safer.	Responses		Percentage of case
	Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws	30	10.9%	17.0%
	Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk	30	10.9%	17.0%
	Requiring motorcyclists to wear a helmet	27	9.8%	15.3%
	Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license	55	20.0%	31.2%
	Enforcing speed limit laws through the use of speed camera	30	10.9%	17.0%
	Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring	103	37.5%	58.5%
	Total	275	100.0	156.2%

Q 15.V3	The following statements related to ideas being discussed as possible ways to make roads safer.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safer	278	71.5%	111	28.5%	389	100.0%

Q15	The following statements related to ideas being discussed as possible ways to make roads safer.	Responses	Percentage of case	
	Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws	150	23.0%	54.0%
	Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk	98	15.0%	35.3%
	Requiring motorcyclists to wear a helmet	66	10.1%	23.7%
	Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license	115	17.6%	41.4%
	Enforcing speed limit laws through the use of speed camera	113	17.3%	40.6%
	Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring	111	17.0%	39.9%
	Total	653	100.0%	234.9%

Q 15. V4	The following statements related to ideas being discussed as possible ways to make roads safer.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Road safer	337	86.6%	52	13.4%	389	100.0%

Q15	The following statements related to ideas being discussed as possible ways to make roads safer.	Responses		Percentage of case
	Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws	181	14.4%	53.7%
	Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk	238	19.0%	70.6%
	Requiring motorcyclists to wear a helmet	280	22.3%	83.1%
	Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license	200	16.0%	59.3%
	Enforcing speed limit laws through the use of speed camera	230	18.4%	68.2%
	Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring	124	9.9%	36.8%
	Total	1253	100.0%	371.8%

Q 16. V1	The following statements related to speed cameras in enforcing speed limit laws.		
	Valid	Missing	Total

	N	Percent	N	Percent	N	Percent
Speed camera	152	39.1%	237	60.9%	389	100.0%

Q16	The following statements related to speed cameras in enforcing speed limit laws.	Responses		Percentage of case
	These systems would reduce speeds and save lives	21	10.2%	13.8%
	These systems would cost less than human enforcement	23	11.2%	15.1%
	These systems would free law enforcement officials to prevent crimes and catch criminals	23	11.2%	15.1%
	These systems would be extremely accurate identifying speeders	32	15.6%	21.1%
	No one has to worry about tickets if they simply obey the law	7	3.4%	4.6%
	Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed	57	27.8%	37.5%
	An independent company would monitor the system to ensure the government is not misusing the data being gathered	42	20.5%	27.6%
	Total	205	100.0%	134.9%

Q 16. V2	The following statements related to speed cameras in enforcing speed limit laws.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Speed camera	241	62.0%	148	38.0%	389	100.0%

Q16	The following statements related to speed cameras in enforcing speed limit laws.	Responses		Percentage of case
	These systems would reduce speeds and save lives	42	8.8%	17.4%
	These systems would cost less than human enforcement	56	11.8%	23.2%
	These systems would free law enforcement officials to prevent crimes and catch criminals	72	15.1%	29.9%
	These systems would be extremely accurate identifying speeders	88	18.5%	36.5%
	No one has to worry about tickets if they simply obey the law	42	8.8%	17.4%
	Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed	81	17.0%	33.6%
	An independent company would monitor the system to ensure the government is not misusing the data being gathered	95	20.0%	39.4%
	Total	476	100.0%	197.5%

Q 16.V3	The following statements related to speed cameras in enforcing speed limit laws.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Speed camera	352	90.5%	37	9.5%	389	100.0%

Q16	The following statements related to speed cameras in enforcing speed limit laws.	Responses		Percentage of case
	These systems would reduce speeds and save lives	159	14.7%	45.2%
	These systems would cost less than human enforcement	174	16.1%	49.4%
	These systems would free law enforcement officials to prevent crimes and catch criminals	164	15.2%	46.6%
	These systems would be extremely accurate identifying speeders	147	13.6%	41.8%
	No one has to worry about tickets if they simply obey the law	189	17.5%	53.7%
	Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed	110	10.2%	31.2%
	An independent company would monitor the system to ensure the government is not misusing the data being gathered	139	12.8%	39.5%
	Total	1082	100.0%	307.4%

Q 16. V4	The following statements related to speed cameras in enforcing speed limit laws.					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Speed camera	323	83.0%	66	17.0%	389	100.0%

Q16	The following statements related to speed cameras in enforcing speed limit laws.	Responses		Percentage of case
	These systems would reduce speeds and save lives	167	17.4%	51.7%
	These systems would cost less than human enforcement	136	14.2%	42.1%
	These systems would free law enforcement officials to prevent crimes and catch criminals	130	13.5%	40.2%
	These systems would be extremely accurate identifying speeders	122	12.7%	37.8%
	No one has to worry about tickets if they simply obey the law	151	15.7%	46.7%
	Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed	141	14.7%	43.7%
	An independent company would monitor the system to ensure the government is not misusing the data being gathered	113	11.8%	35.0%
	Total	960	100.0 %	297.2%

Q 17. V1	The following statements against using speed cameras in enforcing speed limit laws					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Against camera	285	73.3%	104	26.7%	389	100.0%

Q17	The following statements against using speed cameras in enforcing speed limit laws	Responses		Percentage of case
	The government would invade privacy with the information they could gather	140	15.7%	49.1%
	These systems have made errors, so people would be treated unfairly	115	12.9%	40.4%

	It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers	188	21.1%	66.0%
	No one knows if these systems would actually save lives	108	12.1%	37.9%
	Drivers would find ways to evade the camera systems and avoid the law	49	5.5%	17.2%
	It would cost too many tax to buy, install and maintain all of the cameras	82	9.2%	28.8%
	Local government officials cannot be trusted to run this system well	113	12.7%	39.6%
	Using this system would take jobs away from hard-working law enforcement officials	94	10.6%	33.0%
	Total	889	100.0%	311.9%

Q 17. V2	The following statements against using speed cameras in enforcing speed limit laws					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Against camera	329	84.6%	60	15.4%	389	100.0%

Q17	The following statements against using speed cameras in enforcing speed limit laws	Responses		Percentage of case
	The government would invade privacy with the information they could gather	133	13.0%	40.4%
	These systems have made errors, so people would be treated unfairly	145	14.1%	44.1%
	It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers	123	12.0%	37.4%
	No one knows if these systems would actually save lives	126	12.3%	38.3%
	Drivers would find ways to evade the camera systems and avoid the law	116	11.3%	35.3%
	It would cost too many tax to buy, install and maintain all of the cameras	140	13.6%	42.6%
	Local government officials cannot be trusted to run this system well	131	12.8%	39.8%
	Using this system would take jobs away from hard-working law enforcement officials	113	11.0%	34.3%
	Total	1027	100.0 %	312.2%

Q 17.V3	The following statements against using speed cameras in enforcing speed limit laws					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Against camera	315	81.0%	74	19.0%	389	100.0%

Q17	The following statements against using speed cameras in enforcing speed limit laws	Responses	Percentage of case

	The government would invade privacy with the information they could gather	100	10.8%	31.7%
	These systems have made errors, so people would be treated unfairly	107	11.6%	34.0%
	It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers	53	5.7%	16.8%
	No one knows if these systems would actually save lives	130	14.1%	41.3%
	Drivers would find ways to evade the camera systems and avoid the law	168	18.2%	53.3%
	It would cost too many tax to buy, install and maintain all of the cameras	110	11.9%	34.9%
	Local government officials cannot be trusted to run this system well	114	12.3%	36.2%
	Using this system would take jobs away from hard-working law enforcement officials	143	15.5%	45.4%
	Total	925	100.0 %	293.7%

Q 17. V4	The following statements against using speed cameras in enforcing speed limit laws					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Against camera	138	35.5%	251	64.5%	389	100.0%

Q17	The following statements against using speed cameras in enforcing speed limit laws	Responses		Percentage of case
	The government would invade privacy with the information they could gather	16	5.9%	11.6%
	These systems have made errors, so people would be treated unfairly	22	8.1%	15.9%
	It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers	25	9.2%	18.1%
	No one knows if these systems would actually save lives	25	9.2%	18.1%
	Drivers would find ways to evade the camera systems and avoid the law	56	20.7%	40.6%
	It would cost too many tax to buy, install and maintain all of the cameras	57	21.0%	41.3%
	Local government officials cannot be trusted to run this system well	31	11.4%	22.5%
	Using this system would take jobs away from hard-working law enforcement officials	39	14.4%	28.3%
	Total	271	100.0 %	196.4%

Chapter 5

CHOICE EXPERIMENT RESULTS

5.1 Introduction

In this chapter, we evaluate the drivers' WTP for road safety improvements in North Cyprus by using CE models. Each driver has a difference preferences and feeling or perception about risk of fatalities or injuries (Jones-Lee & Loomes, 1995; Viscusi & Zeckhauser, 2005).

5.2 Descriptive of Data

The sample choice set used for 389 respondents in the CE method is presented in Figure 5.1. Table 5.1 presents the total numbers of respondents in each choice set and subsequently in each version.

	Route A	Route B	Current Route
Speed camera (per lane)	1	2	
Average speed limit (km/h)	90	80	Neither route A
Travel time (min)	60 min or less	61 to 120 min	nor route B
Running costs (TL)	20%	10%	I prefer to stay
Fatal crashes (per year)	Fewer than 10 people	10 people or more	with my current
Injuries (per year)	20 people or more	Fewer than 20 people	route

Figure 5.1: Typical CE Card

Table 5.1: Descriptive statistic of respondents to each version

Version	Total	Route	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Set 7	Set 8	Total	Total sets
1	132	A	47	40	50	45	41	47	53	44	367	1056
		B	31	35	32	39	34	37	32	34	274	
		C	54	57	50	48	57	48	47	54	415	
2	70	A	24	25	23	22	26	21	23	24	188	560
		B	27	29	20	26	21	27	21	24	195	
		C	19	16	27	22	23	22	26	22	177	
3	83	A	23	30	19	34	20	32	21	20	199	656
		B	13	22	28	17	27	46	32	31	216	
		C	46	30	35	31	35	4	29	31	241	
4	104	A	23	30	30	29	46	27	53	22	260	840
		B	23	31	32	19	36	20	39	38	238	
		C	59	44	43	57	23	58	13	45	342	
Total	389		389	389	389	389	389	389	389	389	3112	3112
		A	117	125	122	130	133	127	150	110	1014	33%
		B	94	117	112	101	118	130	124	127	923	30%
		C	178	147	155	158	138	132	115	152	1175	38%
		Total	389	389	389	389	389	389	389	389	3112	

Four different versions were presented to the targeted 389 respondents in five districts. A total of 510 interviewees were recruited among individuals who drove on a regular weekday for any purpose, such as education, work, personal business, or bureaucratic purposes. From these, 15 protest bids respondents who choice the reason 3 were excluded. Table 5.2 presents the respondents' reasons to choice current route on all different version of choice sets. Also, 121 respondents answered the choice experiments base on lexicographic decision-making rules, i.e. they picked an alternative that was uniquely the best combination of attributes. There were 54 lexicographic respondents for the cost attribute, 30 for the number of death and injuries attributes, and 37 for the travel time attribute.

Therefore, The data with this characteristic were removed from the analyses (Johnson et al., 2000; Saelensminde, 2001; Rizzi and Ortúzar, 2003).

Table 5.2: Fundamental Reason to Choose the Status quo

		Number of observations
1	We are satisfy with current route.	50
2	There are not any different between alternatives and current route.	24
3	Chose the current route due to the roads are improved.	15
4	We do not want additional expenses.	22
5	The current route is less expensive than other.	7
6	The best alternative is current route.	11
7	The improved roads are not suitable for me.	19
8	Apart from the increases in running cost, I am satisfy with current route.	4
9	No specific reason.	1

The 374 respondents generated 2992 choice sets, of that total 1,939 of them chose the new route A and B and 1,053 chose the current route (Table 5.3). In general the alternatives of improved road A and B with higher speed cameras were preferred over ones with lower levels (around 51.6%). The rate of average speed limits levels 60km and 90km were 26.71% and 26.1% respectively. With respect to the speed limits, the most travel time level occurred 50.75% of the time (61 to 120 min). Fewer than 20 people injured per year were 50.54%. More than 10 people death per year were 59.4%. The most frequently chosen percentage change in monthly running costs for the trip level was the lowest percentage change 5% (26%) and the highest percentage change 20% (23.6%).

In terms of current route, 61% of respondents chosen a two speed cameras on the route, Average speed limits was around 45.4% less than 75km per hour, the most travel time level occurred 63% of the time (61 to 120 min), 20 people or more

injured and fewer than 10 people killed per year (around 63% and 75% respectively).

Table 5.3: Statistical Analysis of Alternatives and Levels Distributions

Alternative		
A	1015	33.92%
B	924	30.88%
C	1053	35.19%
Total	2992	
A and B	1939	
Number of speed camera per lane		
1	947	48.84%
2	990	51.06%
Average speed limits (km/h)		
60	518	26.71%
80	435	22.43%
90	506	26.10%
100	480	24.76%
Travel Time (per lane type)		
60 min or less	954	49.20%
61 to 120 min	983	50.70%
Number of injuries		
fewer than 20 people	983	50.54%
20 people or more	956	49.36%
Number of death		
fewer than 10 people	957	50.6%
10 people or more	982	59.4%
Percentage change in monthly running costs		
5% or higher	503	25.94%
10% or higher	500	25.79%
15% or higher	476	24.55%
20% or higher	458	23.62%
Current Route	1053	
Number of speed camera per lane		
1	410	38.94%
2	643	61.06%
Average speed limits (km/h)		

sl <= 75	478	45.39%
75<sl <=80	345	32.76%
80<sl <=85	103	9.78%
sl <=90	127	12.06%
Travel Time (per lane type)		
60 min or less	389	36.94%
61 to 120 min	664	63.06%
Number of injuries		
fewer than 20 people	389	36.94%
20 people or more	664	63.06%
Number of death		
fewer than 10 people	798	75.8%
10 people or more	255	24.2%

5.3 Value Risk Reduction

Suppose a trip on a particular route which is used by N users gives a certain level of dissatisfaction as defined by the static indirect utility function V = V(r, c, t), where r denotes the risk of being killed or injured, c the cost of traveling, and t the travel time on a route. Other attributes are also considered in the analysis that follows.

The estimated VRR is the value of avoiding premature fatality per unit of time within the aggregating demand for this public good, in this case road safety (Drèze, 1962; Jones-Lee, 1974). Equation (1) measures the MRS between the risk of the fatality (or injury) and income on a specific trip. This is expressed as:

$$\mathrm{MRS_j} = \frac{\partial \mathrm{V}_j / \partial \mathrm{r}}{\partial \mathrm{V_j} / \partial \mathrm{c}_{|\,\mathrm{V}=\bar{\mathrm{v}}}} \qquad (1)$$

The value of improving road safety to society is equal to the MRS_j between the risk of fatality (or injury) and income for each individual that is then summed over the entire population, plus a covariance that measures the strength of the correlation

between the MRS_j and the reduced risk (δr_j).[9] To express this value as an average for each of the *N* members of the population, we need to divide this sum by *N*. This is expressed in equation (2) as:

$$VRR = \frac{1}{N}\sum_{j=1}^{N} \mathrm{MRS_j} + \mathrm{N\ cov}\left(\mathrm{MRS}_j, \left|\delta r_j\right|\right) \quad (2)$$

It is typically assumed that the covariance between MRS and δr in equation (2) is zero when δr were the same for all individuals. Therefore, N represents the total number of automobile drivers on a particular route in a given year and WTP is MRS between the risk of fatality (or injury) and income. Then the Equation (2) can express as:

$$VRR = \frac{1}{N}\sum_{j=1}^{N} \mathrm{MRS_j} \quad (3)$$

In terms of the functional form of V_j, MRS depends on each individual's risk perception of his or her own risk. From a respondent's standpoint using the fatalities (or injuries) is more understandable. Risk is now measured by the numbers of fatalities as proportion of the population (r = f/N), where the number of fatalities is denoted as f. Equation (1) can then be made a function of the changes in f and written as equation (4):

$$MRS_j = N\frac{\partial V_j/\partial f}{\partial V_j/\partial c}_{|V=\bar{v}} \quad (4)$$

Substituting equation (4) for MRS_j in equation (3) yields equation (5), which sums the MRS between the number of fatalities (or injuries) and income over all the road users.

$$VRR = \sum_{j=1}^{N} \frac{\partial V_j/\partial f}{\partial V_j/\partial c}_{|V=\bar{v}} \quad (5)$$

[9] $\mathrm{cov}\,(MRS_j, \delta r_j) = \sum_j \frac{MRS_j \delta r_j}{N} - \sum_j \frac{MRS_j}{N} \sum_j \frac{\delta r_j}{N}$

5.4 Making the Model Operational

We now turn to the above model within a discrete choice framework where the static indirect utility function, V_{ji}, is defined by alternative *i* perceived by individual *j*:

$$V_{ji} = \beta_1 * f_{ji} + \beta_2 * I_{ji} + \beta_3 * c_{ji} + \beta_4 * t_{ji} \quad (6)$$

In equation (6), f denotes the number of fatalities, I denote the number of injuries, c denotes the cost of traveling and t refers to the travel time on a route. The subjective value of fatality (SVF_j) is equal to β_1/β_3 for fatalities for each individual, and β_2/β_3 is the subjective value of injury (SVI_j) for injuries for each individual (Hojman et al., 2005). By computing β_4/β_3, we obtain the individual's subjective value of travel time ($SVTT_j$) (Hensher et al., 2005).

We assume V_{ji} to be a linear function of the attributes of the travel. As we cannot observe all the relevant information in the utility function, let U_{jci} denote the random utility function of alternative i in choice set c perceived by individual j, which in turn is expressed as a deterministic V_{jci} and a random component ε_{jci}:

$$U_{jci} = V_{jci} + \varepsilon_{jci} \quad (7)$$

Assumes random component ε is independent and identically distributed (IID) and distributed EVI among alternatives and across individuals in choice set c. The probability of homogeneous parameters in MNL model that individual j associates with alternative i in choice set c can be formulated as:

$$E\left[P_{jci}\right] = \frac{\exp^{Vjci}}{\sum_{j=1}^{J} \exp^{Vjci}} \quad (8)$$

Unlike the homogeneous parameters in the MNL model, we assume that some of the parameters (β_n) vary between individuals. The expected probabilities of choosing a particular alternative, therefore, depend on the random parameters. Since the random parameters are not known, the unconditional choice probability is estimated and used

in the model evaluations. The integral is estimated with simulated maximum likelihood techniques.

$$P_{jci} = \int E\left[P_{jci}\,|\beta_n\right] f\,(\beta_n|\alpha)\;d\alpha \tag{9}$$

where α stands for the parameters of the distribution.

5.5 Estimating Values of Statistical Life and Injury

The WTP per trip for prevention of fatalities risk and injuries risk is now calculated for automobile drivers. The values for SVF_j and SVI_j are estimated from equation (6) and then summed over all the drivers, as shown in equation (5), to calculate the average WTP of a driver to reduce the risks on a single trip by one event. The automobile driver population exposure to risk is measured by the number of trips of each driver and associated kilometers per trip. The average WTP per driver per trip to reduce fatalities or injuries will be determined by, among other things, the risk or chance of such an event occurring during the trip. The WTP per kilometer is found by dividing the WTP per trip by the number of kilometers per trip. The estimation of VRR can be derived as (WTP per km)/(chance per km). Chance per kilometer in this situation is measured by the number of fatalities or injuries per annum on the route divided annual average number of kilometers driven on the route (AAVKM). These relationships for each risk class can be expressed as shown in equations (10) and (11):

$$VRR_f = VSL = \frac{\text{WTP per trip}}{\text{Trip kms}} \times \frac{\text{AAVKM}}{\text{\# Fatalities}} \tag{10}$$

$$VRR_I = VI = \frac{\text{WTP per trip}}{\text{Trip kms}} \times \frac{\text{AAVKM}}{\text{\# Injuries}} \tag{11}$$

For the estimations carried out in this study for North Cyprus, the average annual vehicle kilometers traveled is estimated by multiplying the total amount of automobile fuel consumed per year by the fuel efficiency of the automobiles

(kilometers traveled per liter used).

5.6 Modeling Result

5.6.1 The Multinomial Logit Model

Prior to estimating the model, we considered MNL models in which the parameters and attributes enter the utility function with a linear specification or alternatively, as a linear- logarithmic specification. This is done for assessing the best model fit between the other discrete choice models (Louviere et al., 2000). The models with simulated maximum likelihood were estimated using the econometric software package LIMDEP 10.0 NLOGIT 5.0 (Table 5.4 and Appendix 4 for the Nlogit Algorithms).

Table 5.4: MNL Model Specifications

No	Model Specification	LL	Pseudo R^2
	Constant Only Model	-3282.60	0.17
1	U (1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+Bd*d+Bct*ct	-3267.135	0.25
2	U (1,2)=asc+Blsl*lsl+Bsc*sc+Bt*t+Binj*inj+ Bd*d+Bct*ct	-3267.051	0.24
3	U (1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d+Blct*lct	-3262.613	0.27
4	U (1,2)=asc+Blsl*lsl+Bsc*sc+Bt*t+Binj*inj+ Bd*d+Blct*lct	-3262.693	0.25
5	U (1,2)=asc+Blsl*lsl+Blsc*lsc+Bt*t+Binj*inj+ Bd*d+Blct*lct	-3262.693	0.25

From Table 5.4 additive utility function with the attributes Average speed limits (sl), and Number of speed cameras (sc), travel time (t), Number of injuries (inj), Number of death (d) in linear specification, and change in monthly running cost (ct) in natural logarithmic, has the highest value of the log-likelihood:

$$V= \beta asc+ \beta sl* sl+ \beta sc* sc + \beta t*t + \beta inj* inj+ \beta d*d + \beta lct* lct \quad (12)$$

The results of the MNL models estimated are presented in Table 5.5.

Table 5.5: Results of MNL

Attribute	Coefficient (S.E)
ASC	0.5748*** (0.1768)
BSL	- 0.0757 *** (0.01599)
BSC	- 0.0700* (0.04083)
BT	- 0.0556*** (0.02032)
BINJ	- 0.0828*** (0.02031)
BD	- 0.131*** (0.02032)
BLCT	- 0.1865*** (0.04610)
Number of Observations	2992
Log-likelihood	-3262.613
Pseudo R^2	0.27
(*) 90% confidence interval (**) 95% confidence interval (***) 99% confidence interval	

The MNL model based on the first the limitation of heterogeneity in choices of respondents and second the correlation in the error terms is not able to estimate both random and non-random parameters. The limitation may be removed by adding a number of socioeconomic variables, but the independence from irrelevant alternatives (IIA) axiom assumption and IID assumption of the error term are violated in our model, which is tested by using the Hausman test (Appendix 5). Therefore, the MNL results could be biased and unreliable (Hensher et al., 2005). In order to estimate less restrictive model, we moved to the ML.

5.6.2 The Mixed Logit Model

The distribution of random parameters in the ML model allows the coefficient of each attribute varies randomly over respondents.

Let U_{jci} denote the random utility function of alternative i in choice set c perceived by each individual j:

$$U_{jci} = \beta_j X_{jci} + \varepsilon_{jci} \quad (13)$$

Where $\beta_j = b + \eta_j$ Then

$$U_{jci} = \beta_j X_{jci} + \eta_j X_{jci} + \varepsilon_{jci} \quad (14)$$

Using LIMDEP 10.0 NLOGIT 5.0, we considered ML models in which the parameters and attributes enter the utility function with a linear specification or alternatively, as a linear- logarithmic specification.

We specified all parameters to be from an unconstrained triangular distribution, but the mean and standard errors of the majority of parameters were statistically insignificant. This confirms that the existence of preference heterogeneity is insufficient to be captured by an unconstrained distribution. Thus, we estimated all parameters based on a constrained triangular distribution, where the heterogeneity around the mean preserved the sign of parameters by imposing a constraint on the standard error over the entire distribution.

Insignificant standard errors were defined as fixed parameters in the utility function. To identify any statistically significant effect of socioeconomic characteristics in the random parameters, we estimated all potential interactions and removed the insignificant interactions. The final ML model results with interactions are presented in Table 5.6 (Appendix 6 for Nlogit Algorithms).

Table 5.6: Results of Mixed Logit with Interactions

Attributes	Parameters	(t-ratio)
Random parameters		
Constrained triangular distribution		
Sl	−0.0757	(−4.72)
SC	−0.070	(−1.73)
T	−0.054	(−2.68)
INJ	−0.083	(−4.67)
D	−0.131	(−6.45)
Derived standard errors of parameter distributions		
Sl	0.0378	(4.72)
SC	0.0354	(1.73)
T	0.0271	(2.68)
INJ	0.0416	(4.067)
D	0.0658	(6.45)
Fixed parameters		
Constant (ASC)	0.581	(3.27)
LCT	−0.188	(−4.06)
SLAGE Speed limits * age	0.001	(3.82)
SLEDU Speed limits * education	0.031	(3.84)
WTP (TL)		
Constant (ASC) (asc/βct)	-3.088	(-11.285)
SL (βsl/βlct)	0.402	(3.078)
SC (βsc/βlct)	0.376	(1.564)
T (βt/βlct)	0.577	(2.236)
INJ(βinj/βlct)	0.885	(2.904)
D (βd/βlct)	1.40	(3.471)
Halton draws	1,000	
Number of observations	2,992	
LL(0)	−4,752.60	
LL(β)	−3,230.46	
ρ^2	0.32	
Trip distance (km)		
Average	61.28	
St. dev.	27.05	
Min.	8	
Max.	101	

The estimated utility, using equation (15), gave the highest values of ρ^2 (0.32) in the form of an additive utility function. The attributes included are traffic speed limit, speed cameras, travel time, and total number of fatalities and injuries in linear specification, and the change in monthly travel cost expressed in logarithmic form.[10] Estimating the cost attribute as a fixed parameter implies that the distribution of the MWTP for an attribute is equal to the distribution of that attribute's coefficient.

The other attributes were estimated as random parameters assuming constrained triangular distributions. The derived standard deviation of the parameters suggests that a significant level of preference heterogeneity resides within all sampled individuals. Therefore, a single parameter is insufficient to represent the population. Among the interactions between age, gender, education, and personal income with random parameters we found that only two significant interactions can explain the sources of heterogeneity in the preferences of individuals.

$$\text{U (Route A, B)} = \text{ASC} + \beta_{sl} \times \text{speed limit} + \beta_{sc} \times \text{speed cameras} + \beta_{t} \times \text{travel time} + \beta_{death} \times \text{deaths} + \beta_{inj} \times \text{injuries} + \beta_{lct} \times \ln(\text{cost}) + \beta_{slage} \times \text{speed limits} \times \text{age} + \beta_{sledu} \times \text{speed limits} \times \text{education} \quad (15)$$

The mean and standard deviation e of all the attribute coefficients are statistically significant except speed cameras (–1.73). All the coefficients are of the expected signs, including traffic speed limits (–0.075). It might have been expected that greater speed would increase utility because it would reduce travel time. However, once the travel time effect is accounted for in the estimation of utility, it is reasonable that people in general would prefer to experience less tension and drive at

[10] The value of the coefficient on the logarithm of cost variable must be multiplied by the mean of the costs in order to arrive at the marginal utility of cost as reported in Table 6.

lower speeds.

The interaction parameters have no prior expected signs. The interactions between traffic speed limits by age and traffic speed limits by education are positive (0.001 and 0.031, respectively). The interaction between traffic speed limits by age implies that as age increases, the marginal disutility of driving at a high speed declines. The interaction between traffic speed limits by education implies that the marginal disutility associated with the higher speed is lower for drivers who do not have a university degree. However, when evaluated across all individuals, the interaction effect of age and education on utility is small as compared to the overall impact of the traffic speed limits.

We observed that the coefficient of fatalities (–0.131) is larger than the coefficient of injuries (–0.083). This represents that the respondents have a greater marginal utility for avoiding fatalities than for avoiding injuries.

Furthermore, using the Wald command in NLOGIT 5.0 to estimate MWTP and standard error for the attributes. The negative mean of the total travel time parameter (–0.054) implies that travel time saving is preferred. The subjective value of travel time (SVT) for individual trips at the mean of the unconditional estimates was TL34.62 (€11.81) per person hour.[11] Thus, route choice within the sample data was determined by a tradeoff between travel time and cost.

[11] The MRS for the effects coded binary attributes is $MRS_j = 2\frac{\partial V_j/\partial x_j}{\partial V_j/\partial c_{|V=\bar{v}}}$ (Hu et al., 2004) where x denotes the vector of attributes as viewed by individual j. These attributes variables are effects coded as –1 and 1 (a difference of 2), instead of as a dummy variable (0,1). Hence, the estimated coefficient will be half as large as it would be if it were coded as 0,1. To adjust for this, we must multiply the coefficients by two in order to measure the MWTP for a unit change in the variable.

As expected, the marginal utility of travel costs was found to be negative (–0.188) for all individuals. Also, the alternative specific constant (ASC) had a positive mean (0.581) that is associated with the unobserved influences on the choice between a particular route, A or B.

5.6.3 Deriving the Economic Welfare Impacts of Road Safety

The economic welfare impact of improving road safety is a public good, in units of money income, on the road users of a particular route and is estimated by the compensating variation (CV) which estimates the individual's maximum WTP for quality improvement (Silberberg and Suen, 2001). It is the amount that needs to be taken away from the individual's income at the new level of safety (S^1) to make him or her as well off as at the initial level of safety (S^0) (Hanemann, 1991). In terms of the indirect utility function, this can be represented as:

$$V(P^0, S^0, Y) = V(P^0, S^1, Y - CV) \quad (16)$$

Where P^0 is the vector of prices and Y is the individual's income.

We defined the travel cost in terms of natural logarithmic form.[12] Therefore, the economic welfare impact of an improvement in road safety an average respondent under the different scenarios, as compared with keeping the respondent at his or her current utility level, was calculated as follows:

Current route utility, V^0, is

$$V^0 = \beta_{sl} * sl^0 + \beta_{sc} * sc^0 + \beta_t * t^0 + \beta_{inj} * inj^0 + \beta_d * d^0 + \beta_{lct} * lct^0 \quad (17)$$

$$lct^0 = \ln(chctytl^0 + 1)$$

$chctytl^0 = 0$, then V^0 simplifies to

$$V^0 = \beta_{sl} * sl^0 + \beta_{sc} * sc^0 + \beta_t * t^0 + \beta_{inj} * inj^0 + \beta_d * d^0 \quad (18)$$

$$V^1 \mid_{chctytl=0} = \beta_{asc} + \beta_{sl} * sl^1 + \beta_{sc} * sc^1 + \beta_t * t^1 + \beta inj * inj^1 + \beta_d * d^1 \quad (19)$$

[12] We define ln (0+1) to avoid having ln (0), (Moeltner and Layton, 2002).

$$V^1 \mid_{chctytl=0} - V^0 \quad (20)$$

$$lct^1 = \ln(chctytl^0 + 1 + CV)$$

$$lctl^1 = \ln(1+CV)$$

$$V^1 = \beta_{asc} + \beta_{sl} * sl^1 + \beta_{sc} * sc^1 + \beta_t * t^1 + \beta_{inj} * inj^1 + \beta_d * d^1 + \beta_{lct} * lct^1$$

$$= V^1 \mid_{chctytl=0} + \beta_{lct} * lct^1$$

$$= V^1 \mid_{chctytl=0} + \beta_{lct} * \ln(1+CV) \quad (21)$$

From the definition of compensating variation

$$V^1 - V^0 = 0$$

$$[V^1 \mid_{chctytl=0} + \beta_{lct} * \ln(1+CV)] - V^0 = 0$$

$$\ln(1+ CV) = \left(\frac{1}{\beta_{lct}} [V^0 - V^1 \mid_{chctytl=0}]\right)$$

$$CV = \exp\left(\frac{1}{\beta_{lct}} [V^0 - V^1 \mid_{chctytl=0}]\right) - 1 \quad (22)$$

The maximum welfare impact of an improvement in road safety under different scenarios was equivalent to a TL34.30 (€11.70) increase in the monthly travel cost with regard to the level of preference of each individual. This happens for 25 one-way trips per month taking 60 min or less, with one speed camera each way, a speed limit of 85km/h, and with fewer than 10 deaths and 20 injuries from automobile accidents per year (Table 5.7). The average welfare impact values are estimated per month. Thus, it is necessary to convert the result from a per-month to a per-car-trip basis, given that the exposure rate relates to trips. Therefore, the welfare impact for an average of 25 one-way car trips per month is calculated as a TL1.37 (€0.47) increase in travel costs per car trip.

Table 5.7: Results of CV

CV TL/month	S.E. TL/month	95% confidence interval TL/month	
		Lower bound	Upper bound
34.30 (€11.70)	13.95 (€4.76)	6.96 (€2.37)	61.64 (€21.03)

Delta method used to obtain standard errors (Greene, 2000).

5.6.4 Deriving the Value of the Risk Reduction

Table 5.8 shows the primary results for average WTP based on the number of deaths and injuries as random parameters for avoiding fatalities and injuries on roads. The average WTP for a reduction in deaths, TL1.40 per car trip, is systematically higher than the WTP for a reduction in injuries, TL0.88 per car trip.

Table 5.8: Willingness To Pay (YTL/Trip/Driver)

Attribute	Average (TL per car trip)	S.E.
Death	1.40 (€0.48)	0.40
Injury	0.88 (€0.30)	0.30

To estimate the average VRR according to equation (5), we need to estimate the WTP parameters for deaths and injuries per person per kilometer (The average distance between the five districts of Northern Cyprus in our sample is 47.68 km) and divide this value by the incidence of death and injury separately, using equations (10) and (11). The chance of death or injury is measured by the relationship between the risk of deaths or injuries per annum and the average annual number of vehicle kilometers on the route. The results are presented in Table 5.11.

We estimated the average annual vehicle kilometers traveled in North Cyprus by multiplying the total amount of automobile fuel consumed by the fuel efficiency of

automobiles. The average fuel efficiency of the fleet of automobiles in North Cyprus was estimated to be 10 liters/100km.[13]

The data used to calculate the chance of death or injury was collected from the Road Safety Branch of the Road and Traffic Authority (RTA) of North Cyprus and the State Planning Organization. These data cover the number of fatalities. A fatality is defined as a person who dies within 30 days of an accident as a result of injuries received in that accident. The number of injuries is measured by the number of non-fatal crashes in which at least one person was injured. The final estimated values of the chance of fatality or injuries and VRR, using equations (10) and (11), are reported in Table 5.9.

Table 5.9: The Chance of Fatality and Injuries and the VRR

Number of casualties		Trip lengths (km)	Exposure AAVKM	Chance of		VRR (TL) per	
Fatalities	Injuries			Fatality	Injury	Fatality	Injury
40	1067	47.68	2.86×10^{9}	1.40×10^{-8}	3.73×10^{-7}	2,099,563	49,474

[13] The European Union Automotive Fuel Economy Policy (UNEP) approved a fuel consumption of around 5.6 liters/100km of petrol or 4.9 liters/100km of diesel. However, the average fuel consumption is 'combined' 8.9 l, 'urban' 12.5 l, and 'extra-urban' 6.9 l per 100km. In North Cyprus, average fuel consumption for car travel is 12.5 liters/100km in city traffic. If truck traffic is also included, a reasonable estimate would be 10 liters/100km (http://en.wikipedia.org/wiki/Fuel_economy_in_automobiles, http://www.eea.europa.eu/data-and-maps/figures/growth-in-private-car-travel , http://www.fueleconomy.gov/feg/findacar.htm.

Chapter 6

CONCLUSION AND POLICY IMPLICATIONS

6.1 Introduction

This study provides estimates of the willingness to pay for improving road safety and reduction in the risk of premature death or injuries from road traffic accidents in North Cyprus, using stated choice experiment. Since the driving licenses are issued without examination to foreigners who already have a driving license from elsewhere which is particularly dangerous for a small country with an international university student population of over 50,000, and many long-term tourists from countries with lax driving regulations. There is not even an official handbook for learner drivers to study the rules for their written examination.

Reducing this major social problem, which has economic consequences, will require the selection and implementation of many new investments in the areas of road transport, road safety, and driver education. With the prospect of North Cyprus entering the EU, new investments will need to be undertaken to increase road safety in order to reach EU benchmarks.

While the road network is fairly extensive, it is generally of a low quality. Highways between cities need to be widened with adequate road breakdown lanes; overpasses need to be built at important highway junctions; barriers are needed to separate traffic moving in opposite directions on high-volume expressways with lane dividers installed or improved on busy urban streets; and modern roundabouts need to be built

to replace many existing small roundabouts or busy four-way stop junctions. The important task will be to select those projects, from the many possible ones proposed, that could be justified on the basis of cost–benefit or cost–effectiveness analysis. To conduct such appraisals, a number of key parameter values are required. Three such parameters are VTTS, VSL, VI as a result of improvements in road safety. Therefore, an estimate of the ex ante WTP of drivers to reduce their risk, and hence the value of risk reduction (VRR), can be made.

6.2 Willingness to Pay Value

In the CE section, each version had eight choice sets for each improved route. The attributes of an improved route were the number of speed camera, speed limit and percentage change in running cost the travel time, number of injuries and number of death. Approximately 38% the respondents chose the current route. The economic welfare impact of improving road safety under different scenarios, in units of money income, on the road users of a particular route and is estimated by compensating variation was equivalent to a TL34.30 (€11.70) increase in the monthly travel cost.

6.3 Comparison Value Risk Reduction Estimate with Other Studies

We compared our results with those in other studies that used similar methodology. The VRR that automobile drivers place on the reduction of one fatality is TL 2,099,563 and of one injury TL49, 474. Considering these results, VSL is €717,000, with the 95% confidence interval from €315,293 to €1,117,856, and the VI €16,885, with the 95% confidence interval from €5,603 to €28,186. According to the results reported by De Blaeij et al. (2003) from 30 studies conducted in the USA and some of the European countries, the VSL for road safety was estimated within a wide

range from around €200,000 to more than €10 million.[14] Of these 30 studies, 18 presented lower and higher estimates and 12 gave single point estimates.

Table 6.1: Previous Studies on the Value of Statistical Life in Road Safety in 2014 Euro (×1000)

Author	Country	Single estimate	Lowest estimate	Highest estimate
Atkinson and Halvorson (1990)	US	4738		
Baker (1973)	US		862	12932
Beattie et al. (1998)	UK		1403	15857
Blomquist (1979)	US	1572		
Blomquist and Miller (1992)	US		1508	5835
Carthy et al. (1999)	UK		4209	5477
Cohen (1980)	US	397		
Corso et al. (2000)	US		2439	5793
Desaigues and Rabl (1995)	France		921	21414
Dreyfus and Viscusi (1995)	US	4235		
Ghosh et al. (1975)	UK	1767		
Hansen and Scuffham (1995)	New Zealand		665	21415
Johannesson et al. (1996)	Sweden		5473	6590
Jondrow et al. (1983)	US	1987		

Another source of evidence on VSL is Veisten et al. (2013), who used risk as one of the attributes of a trip in a CE survey for the valuation of casualty risk reduction in Norway. They estimated the VSL to be in the range €7.3 million to €19.2 million based on the risk of fatalities and serious injuries rather than the probability of risks.[15]

[14] The values reported by De Blaeij et al. (2003) are in 1997 USD. These values were adjusted for US inflation between 1997 and 2014 (42%, see inflation calculator on Federal Reserve Bank of Minneapolis website) and converted to euros using an exchange rate of €1=$1.36 for May 2014 (US Federal Reserve Board website).

[15] We adjusted values using an inflation calculator and converted to euros using an exchange rate of €1=NOK8.1533 for May 2014 (Central Bank of Norway website).

At the EU level, the value of statistical life most frequently used is €1 million. This is related to the 'one-million-euro rule' for the CBA of safety-enhancing interventions (Despontin et al., 1998; European Transport Safety Council, 2007). The VSL is evaluated as the economic damage of a death. This amount is used as a benchmark for deciding which safety-enhancing intervention to select. In the EU, for every €1 million spent on a road safety measure, at least one death should be prevented (Despontin et al., 1998, Wesemann, 2000).

The point estimate of the VSL for North Cyprus obtained from this study was below €1 million, which places it in among the bottom 30% of the estimates reported by De Blaeij et al. (2003). An important consideration is that North Cypriot households have a significantly lower income than the European average. Evidence suggests that the income elasticity of the VSL is equal to or greater than one in lower-income populations, implying that the VSL is a luxury good (Hammitt and Robinson, 2011; Milligan et al., 2014). Under the standard assumption that a high degree of risk aversion usually implies high values for the income elasticity of the VSL (Andersson and Treich, 2011), it could also be that a lower value of VSL implies that the people of a given community have a lower degree of risk aversion.

To check the consistency of our results with those of European countries, we adjusted our results for the differences between the levels of income in North Cyprus and in European countries. We used our estimate to extrapolate the benefit transfer for Europe based on per capita gross national income (GNI) and with reasonable assumptions of the income elasticity of VSL. In 2014, GNI was about €10,989 in

North Cyprus, compared to €26,262 in the European Union.[16]

If the income elasticity was 1, the benefit transfer function would be about €1,714,84 $\left[\mathrm{VSL}_{\mathrm{Europe}} = 717{,}000\ (\ \mathrm{GNI}_{\mathrm{Europe}} / \mathrm{GNI}_{\ \mathrm{Cyprus}})\text{^}\ 1\right]$, and if the elasticity was 1.2 it would be € 2,041,572 $\left[\mathrm{VSL}_{\mathrm{Europe}} = 717{,}000\ (\ \mathrm{GNI}_{\mathrm{Europe}} / \mathrm{GNI}_{\ \mathrm{Cyprus}})\text{^}\ 1.2\right]$. The higher elasticity leads to WTP estimates that are an increasing fraction of income for high-income countries. We found that these adjusted estimates are at least 50% higher than the value of €1 million per human life used by the EU in the cost–benefit studies of safety enhancement interventions. They are also close to the median of the other reported estimates of the value of VSL, but below the means for the USA, Europe and New Zealand.

To summarize, we developed a new empirical estimate in the transport field of the WTP of North Cyprus residents to reduce fatalities, €717,000, and to avoid injuries, €16,885. We also estimated the value that drivers in North Cyprus place on the time saved in road travel at €11.85 per person hour.

6.4 Policy Implications

Given the very high incidence of road deaths and injuries in North Cyprus as compared with that in the rest of the Western world, many investments in this area need to be undertaken to reduce current the level of casualties. The important task will be to select those projects, among the many possible ones, that can be justified

[16] These values are reported by the World Bank (EU data on World Bank website) and Turkish Republic of Northern Cyprus State Planning Organization. We adjusted the value for the EU using an inflation calculator (HICP table on Eurostat website) and converted to euros using an exchange rate of €1=$1.36 for May 2014 (US Federal Reserve Board website). This value for North Cyprus is €1=TL2.93 for May 2014 and was taken from the Central Bank of the Republic of Turkey's website.

on the basis of cost–benefit analysis (Jenkins et al., 2014). In terms of policy tools, our findings provide a set of information on the value of risk reduction that is useful in the ex ante appraisals of road projects that not only reduce travel times and vehicle operating costs but have also been shown to be effective in reducing highway deaths and injuries.

With the prospect of North Cyprus entering the EU in the near future, many such investments must be initiated in order to achieve EU benchmarks for road quality and safety. Given the limited public investment budget of North Cyprus, such investment interventions will need to be subject to a professional appraisal where the economic benefits are compared with the economic costs. The potential for choosing ineffective and wasteful projects is very much present.

An area of future research should be to distinguish the routes in North Cyprus between those with a high risk of fatalities and injuries and those with moderate levels of risk. Other researchers have found that the VSL and VI vary considerably with the level of risk and traffic volumes (Rizzi and Ortúzar 2003, 2006). The North Cyprus road network includes extremes of mountain pass roads with both high and low traffic volumes that cross between the north and south zones. They are relatively expensive to improve, in contrast with roads on the inland plains. The levels of risk are also likely to be quite different across these different types of routes. Hence, a more finely calibrated set of estimates of the VSL and VI would improve the measurement of the benefits of road safety improvements in the CBA of such interventions compared with the two single estimates for the whole country produced by this study.

A further area of potentially fruitful research would be to differentiate the injuries by type (non- severe, permanent, hospitalized). Although this information is not collected at present, it could be gathered in the future for each route in this small region. Furthermore, as the number of injured people who move away from the region is rather low, North Cyprus is likely to be a very good place to measure the lifetime cost of such injuries.

REFERENCES

Adamowicz, W., Louviere, J. J., & Williams, M. (1994). Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities. *Journal of Environmental Economics and Management*, 26(3), 271-292.

Adamowicz, W., Boxall, W., & Louviere, J. J. (1998). Stated preference approaches for measuring passive use values: choice experiments and contingent valuation, *American Journal of Agricultural Economics*, 80, 64–75.

Adamowicz, W., & Boxall, P. (2001). Future directions of stated choice methods for environmental valuation. *Paper presented to the Choice Experiments: A New Approach to Environmental Valuation Conference*, South Kensington, London, April.

Andersson, H. (2007). Willingness to pay for road safety and estimates of the risk of death: Evidence from a Swedish contingent valuation study. *Accident Analysis and Prevention*, 39, 853–865.

Andersson, H., & Treich, N. (2011). *Handbook in Transport Economics*, Chapt. 'The Value of a Statistical Life', pp. 396-424, in de Palma, A., R. Lindsey, E.Quinet and R. Vickerman (eds.) Edward Elgar, Cheltenham, UK.

Arrow, K., Solow, R., Portney, P. R., Radner, R., & Schuman, H. (1993). *Report of the NOAA Panel on Contingent Valuation. Fed. Reg.*, 58, 4601-4614.

Barton, D. N. (2007). Norwegian AQUAMONEY Case Study on Valuation of Environmental and Resource Costs of Water Services. *Morsa Case Study Status Report*, AquaMoney, Development and Testing of Practical Guidelines for the Assessment of Environmental and Resource Costs and Benefits in the WFD, Contract no SSPI-022723.

Bateman, I. J., Nishikawa N., & Brouwer, R. (1999). Benefit Transfer in Theory and Practice: A Review. *Paper presented at recent developments in Environmental valuation*. Forestry Commission/ Civil Service, Barony Castle, Scotland, May.

Beattie, J., Covey, J., Dolan, P., Hopkins, L., Jones-Lee, M., Loomes, G., Pidgeon, N., Robinson, A., & Spencer, A. (1998). On the Contingent Valuation of Safety and the Safety of Contingent Valuation: Part 1 – Caveat Investigator. *J. Risk Uncertain*, 17, 5–25.

Bennett, J. (1996). The contingent valuation method; *A post-Kakadu assessment*. Agenda, 5(2), 185-194.

Boman, M., Bostedt, G., & Kriström, B. (1999). Obtaining Welfare Bounds in Discrete-Response Valuation Studies: A Non-Parametric Approach. *Land Economics*, 75(2), 284-294.

Boxall, P. C., & Adamowicz, W. L. (2002). Understanding Heterogeneous Preferences in Random Utility Models: A Latent Class Approach. *Environmental and Resource Economics*, 23(4), 421-446.

Bunch, D. S., Louviere, J. J., & Anderson, D. A. (1996). A Comparison of Experimental Design Strategies for Choice-Based Conjoint Analysis with Generic-Attribute Multinomial Logit Models. *Working Paper*, Graduate School of Management, University of California, Davis, CA.

Carlsson, F., & Martinsson, P. (2003). Design Techniques for Stated Preference Methods in Health Economics. *Health Econ*omy, 12(4), 281–294.

Carlsson, F., & Martinsson, P. (2006). How Much is Too Much? -An Investigation of the Effect of the Number of Choice Sets, Starting Point and the Choice of Bid Vectors in Choice Experiments. Göteborg University, Department of Economics, *Working Papers* in Economics number 191.

Carlsson, F., & Martinsson, P. (2008). Does it Matter When a Power Outage Occurs? A Choice Experiment Study on the Willingness to Pay to Avoid Power Outages. *Energy Economics*, 30(3), 1232- 1245.

Carson, R. T., Wilks, L., Imber, D. (1994). Valuing the Preservation of Autralia's Kakadu Conservation Zone. *Oxford Economic Papers*, 46, 727-49.

Carson, R. T., Conaway, M. B., Hanemann, W. M., Krosnick, J. A., Mitchell, R. C., & Presser, S. (2004). Valuing oil spill prevention: A case study of California's central coast. Dordrecht, The Netherlands: *Kluwer Academic Publishers*.

Carthy, T., Chilton, S., Covey, J., Hopkins, L., Jones-Lee, M., Loomes, G., Pidgeon, N., & Spencer, A. (1998). On the Contingent Valuation of Safety and the

Safety of Contingent Valuation: Part 2 – The CV/SG 'chained' approach. *Journal Risk Uncertain*, 17, 187–214.

Caussade, S., Ortuzar, J. D., Rizzi, L. I., & Hensher, D. A. (2005). Assessing the Influence of Design Dimensions on Stated Choice Experiment Estimates. *Transportation Research: Part B: Methodological*, 39(7), 621-640.

Census, 2011. (2014, January 12).

Retrieved from http://www.devplan.org/Nufus-2011/nufus%20ikinci_.pdf

Central Bank of Norway. (2015, April 29).

Retrieved from http://www.norges-bank.no/en/price-stability/inflation

Central Bank of the Republic of Turkey. (2015, April 29).

Retrieved from http://www.tcmb.gov.tr/wps/wcm/connect/tcmb+en /tcmb+en /main+menu/statistics/exchange+rates/indicative+exchange+rates/

Champ, P. A., Boyle, K. J., & Brown, T. C. (2003). A Primer on Non-Market Valuation. *The Economics of Non-Market Goods and Resources, Kluwer Academic Publishers*, Boston, MA.

CIE. (2001). Review of Willingness-to-Pay Methodologies, *Centre for International Economics*, Canberra & Sydney.

Ciriacy-Wantrup, S. V. (1947). Capital returns from soil-conservation practices. Journal Farm Economics, 29,1181–96

De Blaeij, A. T., Florax, R. J. G. M., Rietveld, P., & Erik, V. (2003). The value of statistical life in road safety: a meta-analysis. *Accident Analysis and Prevention*, 35, 973–986.

Despontin, M., De Brucker, K., Coeck, C., & Verbeke, A. (1998). The economic evaluation of road safety in the European Union. *European Union*, Directorate General VII, Luxembourg.

Dhar, R. (1997). Consumer Preference for a No-Choice Option. *Journal of Consumer Research*, 24, 215.

Diamond, P., & Hausman, J. A. (1994). Contingent valuation: is some number better than no number? *Journal of Economic Perspect*ives, 8, 45–64.

Drèze, J. H. (1962). L'Utilité Sociale d'une Vie Humaine. *Rev. Fr. Rech. Opérat*ion, 6, 93–118.

Elvik, R., Høye, A., Vaa, T., & Sørensen, M. (2009). *The handbook of road safety measures* (2nd ed.). Emerald, Bingley, UK.

European Transport Safety Council. (2007). Social and economic consequences of road traffic injury in Europe. *European Transport Safety Council*, Brussels.

European Commission Road Safety Statistics. (2015, May 23). Retrieved from http://ec.europa.eu/transport/road_safety/specialist/statistics/

Fischhoff, B. (1990). Understanding Long Term Environmental Risks. *Journal of Risk and Uncertainty*, 3, 315-30.

Fischhoff, B. (1991). Value elicitation: is there anything in there? *American Psychologist*, 46, 835–847.

Fischhoff, B. (1997). What do psychologists want? Contingent valuation as a special case of asking questions. *Determining the Value of Nonmarketed Goods eds R. J.* Kopp, W. W. Pommerehne and N. Schwarz, pp. 189–217. Plenum, New York.

Foster, V., & Mourato, S. (2003). Elicitation Format and Sensitivity to Scope. *Environmental and Resource Economics*, 24(2), 141-60.

Gopalakrishnan, S. (2012). A Public Health Perspective of Road Traffic Accidents. *Journal of Family Medicine and Primary Care*, 2012 Jul-Dec, 1(2), 144–150.

Greene, W. (1997). *Econometric Analysis*, 3rd Edition, New york, US: Macmillan.

Greene, W. (2000). *Econometric Analysis*, 4rd Edition, Prentice-Hall, New Jersey.

Haab, T. C., & McConnell, K. E. (1997). Referendum Models and Negative Willingness to Pay: Alternative Solutions. *Journal of Environmental Economics and Management*, 32, 2, 251-270.

Haddak, M., Havet, N., & Lefèvre, M. (2014). Willingness to pay for road safety

improvement. *Working paper 1406* in GATE Groupe'd Analyse et de Théorie Économique Lyon-St Étienne.

Halstead, J. M., Luloff, A. E., & Stevens, T. H. (1992). Protest Bidders in Contingent Valuation. *Northeastern Journal of Agricultural and Resource Economics*, 160-169.

Hammitt, J. K. & Robinson, L. A. (2011). The Income Elasticity of the Value per Statistical Life: Transferring Estimates between High and Low Income Populations. *Journal of Benefit Cost Analaysis*, 2(1), Article 1.

Hanemann, W. M. (1991). Willingness to pay and willingness to accept: how much can they differ? *American Economic Review*, 81(3), 635–647.

Hanley, N., MacMillan, D., Wright, R., Bullock, C., Simpson, I., Parsisson, D., & Crabtree, B. (1998). Contingent valuation versus choice experiments: estimating the benefits of environmentally sensitive areas in Scotland. *Journal of Agricultural Economics*, 49, 1-15.

Hanley, N., Adamowicz, W., & Wright, R. E. (2005). Price Vector Effects in Choice Experiments: An Empirical Test. *Resource and Energy Economics*, 27(3), 227-234.

Hausman, J. A. (1993). Contingent Valuation: A Critical Assessment. North-Holland, Amsterdam.

Hensher, D. A. (1994). Stated preference analysis of travel choices: the state of practice. *Transportation*, 21, 107–134.

Hensher, D. A. (2004). Identifying the influence of stated choice design dimensionality on willingness to pay for travel time. *J. Transp. Econ. Policy*, 38(3), 425–446.

Hensher, D. A., Rose, J., & Greene, W. H. (2005). Applied Choice Analysis: A Primer. *Cambridge University Press*, Cambridge.

Hensher, D. A. (2006). How Do Respondents Process Stated Choice Experiments? Attribute Consideration Under Varying Information Load. *Journal of Applied Econometrics*, 21(6), 861 – 878.

Hensher, D. A., Rose, J., Ortúzar, J. de D., & Rizzi, L. I. (2009). Estimating the willingness to pay and value of risk reduction for car occupants in the road *Transportation Research, Part A*, 43, 629–707.

Hojman, P., Ortúzar, J. de D., & Rizzi, L. I. (2005). On the joint valuation of averting fatal victims and serious injuries in highway accidents. *Journal of Safety Research*, 36, 337–386.

Hu, W., Hunnemeyer, A., Veeman, M., Adamowicz, W. L., & Srivastava, L. (2004). Trading off Health, Environmental and Genetic Modification Attributes in Food. *European Review of Agricultural Economics Advance Access*, 31(3), 389–408.

Huber, J., & Zwerina, K. (1996). The Importance of Utility Balance in Efficient Choice Designs. *Journal of Market Res*earch, 33, 307–317.

Iragüen, P., & Ortúzar, J. D. (2004). Willingness-to-pay for reducing fatal accident risk in urban areas: an internet-based web page stated preference survey. *Accident Analysis Prev*ention, 36, 513–524.

Jenkins, G. P., Kuo, C. Y., & Harberger, A. C. (2014). Cost-Benefit Analysis for Investment Decisions, *John Deutsch International*, Queen's University, Canada.

Johnson, F. R., Matthews, K., & Bingham, M. (2000). Evaluating Welfare-Theoretic Consistency in Multiple-Response, Stated-Preference Surveys. TER Technical *Working Paper* no T0003.

Jones-Lee, M. W. (1974). The value of changes in the probability of death or injury. *Journal of Political Economy*, 82(4), 835–849.

Jones-Lee, M. W., Hammerton, M., & Philips, P. R. (1985). The Value of Safety: Results of a National Sample Survey. *Economic Journal*, 95(377), 49-72.

Jones-Lee, M., O'Reilly, D., & Philips, P. (1993). The Value of Preventing Non-fatal Road Injuries: Findings of a Willingness-to-pay National Sample Survey. TRL Working Paper WPSRC2, *Transport Research Laboratory*, Crowthorne.

Jones-Lee, M. (1994). Safety & the Saving of Life. Cost-Benefit Analysis eds R.

Layard and S. Glaister. *Cambridge University Press*, Cambridge.

Jones-Lee, M., & Loomes G. (1995). Scale and Context Effects in the Valuation of Transport Safety. *Journal of Risk and Uncertainty*, 11(3), 183-203.

Jorgensen, B. S., Syme, G. J., Bishop, B. J., & Nancarrow, B. E. (1999). Protest Responses in Contingent Valuation. *Environmental and Resource Economics*, 14(1), 131-150.

Kjær, T., Bech, M., Gyrd-Hansen, D., & Hart-Hansen, K. (2006). Ordering Effect and Price Sensitivity in Discrete Choice Experiments: Need We Worry? *Health Economics*, 15, 1217–1228.

Kriström, B. (1990). A Non-Parametric Approach to the Estimation of Welfare Measures in Discrete Response Valuation Studies. *Land Economics*, 66(2), 135-139.

Lancsar, E., & Savage, E. (2004). Deriving Welfare Measures from Discrete Choice Experiments: Inconsistency between Current Methods and Random Utility and Welfare Theory. *Health Economics*, 13(9), 901-907.

Lancsar, E., & Louviere, J. (2006). Deleting 'Irrational' Responses from Discrete Choice Experiments: A Case of Investigating or Imposing Preferences? *Health Economics*, 15(8), 797-811.

List, J. A. (2001). Do Explicit Warnings Eliminate the Hypothetical Bias in

Elicitation Procedures? Evidence from Field Auctions for Sports Cards. *The American Economic Review*, 91(5), 1498-1507.

Louviere, J. J., Hensher, D. A., Swait, J. D., & Adamowicz, W. (2000). Stated Choice Methods: Analysis and Application. *Cambridge University Press*, UK.

Milligana, C., Koppa, A., Dahdaha, S., & Montufarb, J. (2014). Value of a statistical life in road safety: A benefit-transfer function with risk-analysis guidance based on developing country data. *Accident Analysis Prev*ention, 71, 236–247.

Mitchell, R., & Carson, R. (1989). Using Surveys to Value Public Goods, The Contingent Valuation Method. Washington, DC: Resources For the Future.

McFadden, D. (1973). Conditional logit analysis of qualitative choice behaviour. *In. P. Zarembka (ed.), Frontiers in Econometrics*, New York: Academic Press, 105-142.

McFadden, D. (1998). Measuring willingness-to-pay for transportation improvements. *Theoretical Foundations of Travel Choice Modelling eds* T. Gärling, T. Laitila and K. Westin, pp. 339–364. Elsevier Science, Amsterdam.

Moeltner, K., & Layton, D. F. (2002). A censored random coefficients model for pooled survey data with application to the estimation of power outage costs. *The Review of Economics and Statistics*, 84(3), 552–561.

Mogas, J., Riera, P., & Bennett, J. (2005). Accounting for Afforestation Externalities:

A Comparison of Contingent Valuation and Choice Modelling. *European Environment*, 15, 44–58.

Mogas, J., Riera, P., & Bennett, J. (2006). A Comparison of Contingent Valuation and Choice Modeling with Second-Order Interactions. *Journal of Forest Economics*, 12, 5–30.

O'Garra, T., Mourato, S., Garrity, L., Schmidt, P., Beerenwinkel, A., Altmann, M., Hart, D., Graesel, C., & Whitehouse, S. (2007). Is the Public Willing to Pay for Hydrogen Buses? A Comparative Study of Preferences in Four Cities. *Energy Policy*, 35, 3630–3642.

Orme, B. (2006). Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research. *Research Publishers LLC*, *Madison*, Wisconsin.

Rizzi, L. I., & Ortúzar, J. D. (2003). Stated preference in the valuation of interurban road safety. Accident Analysis Prevention, 35, 9–22.

Rizzi, L. I., & Ortúzar, J. D. (2006). Road safety valuation under a stated choice framework. *Journal Transport Economic Policy*, 40(1), 69–94.

Road Traffic Accident Prevention Association. (2014, February 17). Retrieved from http://www.tkodkk.org /

Rose, J. M., & Black, I. R. (2006). Means Matter, but Variance Matter Too: Decomposing Response Latency Influences on Variance Heterogeneity in

Stated Preference Experiments. *Marketing Letters*, 17, 4 / December, 295-310.

Russo, J. E., & Barbara D. (1983). Strategies for Multiattribute Binary Choice. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 9 (October), 676-696.

Ryan, M., & Hughes, J. (1997). Using Conjoint Analysis to Assess Women's Preferences for Miscarriage Management. *Health Economics*, 6(3), 261-273.

Ryan, M., & Wordsworth, S. (2000). Sensitivity of Willingness to Pay Estimates to the Level of Attributes in Discrete Choice Experiments. *Scottish Journal of Political Economy*, 47(5), 504-524.

Saelensminde, K. (2001). Inconsistent choices in stated choice data. *Transportation*, 28, 269–296.

Scarpa, R., & Rose, J. M. (2008). Design Efficiency for Non-Market Valuation with Choice Modelling: How to Measure It, What to Report and Why. *The Australian Journal of Agricultural and Resource Economics*, 52, 253–282.

Silberberg, E., & Suen, W. (2001). The Structure of Economics: A Mathematical Analysis (3rd edition). *McGraw-Hill*, Singapore.

Shugan, S. M. (1980). The Cost of Thinking. *Journal of Consumer Research*, 7, 99-111.

Svenssona, M., & Johanssonc, M. V. (2010). Willingness to pay for private and public road safety in stated preference studies: Why the difference?. *Accident Analysis Prevention*, 42, 1205–1212.

Swait, J., & Adamowicz, W. (2001). Choice Complexity and Decision Strategy Selection. *Journal of Consumer Research*, 28, 135-148.

Turkish Republic of Northern Cyprus State Planning Organization. (2015, May 10). Retrieved from http://www.dpo.gov.ct.tr/

Turnbull, B. W. (1976). The Empirical Distribution Function With Arbitrarily Grouped, Censored and Truncated Data. *Journal of the Royal Statistical Society*, B38(3), 290–295.

US Federal Reserve Board. (2015, April 29). Retrieved from http://www.federalreserve.gov/releases/h10/Hist/dat00_eu.htm

Vaughan, W. J., & Rodriguez, D. J. (2001). Obtaining Welfare Bounds in Discrete-Response Valuation Studies: Comment. *Land Economics*, 77(3), 457-465.

Venkatachalam, L. (2004). The Contingent Valuation Method: A Review. *Environmental Impact Assessment Review*, 24, 89–124.

Viney, R., Savage, E., & Louviere, J. (2005). Empirical Investigation of Experimental Design Properties of Discrete Choice Experiments in Health Care. *Health Economics*, 14(4), 349-362.

Viscusi, W. K., Magat, W. A., & Huber, J. (1991). Pricing Environmental Health Risks: Survey Assessments of Risk–Risk and Risk–Dollar Trade Offs for Chronic Bronchitis. *Journal of Environmental Economy and Management*, 21, 32–51.

Viscusi, W. K. (1993). The Value of Risks to Life and Death. *Journal of Economic Literature*, 31(4), 1912-46.

Viscusi, W. K., & Zeckhauser, R. (2005). The Perception and Valuation of the Risks of Climate Change: A Rational and Behavioral Blend. Kennedy School of Government *Working Paper No. RWP05-062*, November 2005.

Veisten, K., Flügel, S., Rizzi, L. I., & Elvik, R. (2013). Valuing casualty risk reductions from estimated baseline risk. *Journal of Research Transport and Econ*omy, 43 (1), 50-61.

Wesemann, P. (2000). Economic evaluation of road safety measures. Contribution to the 117th Round Table, 26 and 27 October 2000, Paris. SWOV Publication D-2000-16E. SWOV *Institute for Road Safety Research*, The Netherlands.

Winer, B. J. (1971). Statistical principles in experimental design (2nd edition). *McGraw-Hill*, New York.

Whitehead, J. C., Groothuis, P. A., & Blomquist, G. C. (1993). Testing for Non-Response and Sample Selection Bias in Contingent Valuation. *Economics Letters*, 41(2), 215-220.

Whittington, D. (1998). Administering Contingent Valuation Studies in Developing Countries. World Development, 26(1), 21–30.

World Bank, EU data. (2015, April 28). Retrieved from http://data.worldbank.org/region/EUU

World Health Organization, Global status reports on road safety. (2015, March 25). Retrieved from http://www.who.int/violence_injury_prevention/2013/report/

World Health Organization, Global status reports on road safety. (2015, March 25). Retrieved from http://www.who.int/violence_injury_prevention/2013/report/

Yoo, S. H., Kwak, S. Y., & Kim, T. Y. (2001). Modelling Willingness to Pay Responses from Dichotomous Choice Contingent Valuation Surveys with Zero Observations. *Applied Economics*, 33(4), 523 – 529.

Yoo, S. H., & Kwak, S. Y. (2009). Willingness to Pay for Green Electricity in Korea: A Contingent Valuation Study. *Energy Policy*, 37(12), 5408-5416.

APPENDICES

Appendix 1: Choice Cards

Route A									Route B					
SET	Block	Profile	Speed	Camera	Travel time	Running costs	Fatal crashes	Injuries	Speed	Camera	Travel time	Running costs	Fatal crashes	Injuries
1	0	8	80	1	61 to 120 min	20% higher than now	Fewer than 10 people	20 people or more	90	2	less than 60 min	5% higher than now	10 people or more	Fewer than 20 people
2	0	14	80	1	60 min or less	10% higher than now	Fewer than 10 people	20 people or more	90	2	61 min to 2 hours	15% higher than now	10 people or more	Fewer than 20 people
3	0	18	60	1	61 to 120 min	15% higher than now	Fewer than 10 people	Fewer than 20 people	80	2	less than 60 min	20% higher than now	10 people or more	20 people or more
4	0	20	90	2	60 min or less	5% higher than now	10 people or more	20 people or more	100	1	61 min to 2 hours	10% higher than now	Fewer than 10 people	Fewer than 20 people
5	0	24	90	2	61 to 120 min	15% higher than now	10 people or more	20 people or more	100	1	less than 60 min	20% higher than now	Fewer than 10 people	Fewer than 20 people
6	0	25	100	2	61 to 120 min	5% higher than now	10 people or more	Fewer than 20 people	60	1	less than 60 min	5% higher than now	Fewer than 10 people	20 people or more
7	0	28	100	2	60 min or less	10% higher than now	10 people or more	Fewer than 20 people	60	1	61 min to 2 hours	15% higher than now	Fewer than 10 people	20 people or more
8	0	31	60	1	60 min or less	20% higher than now	Fewer than 10 people	Fewer than 20 people	80	2	61 min to 2 hours	10% higher than now	10 people or more	20 people or more
9	1	6	60	2	61 to 120 min	10% higher than now	Fewer than 10 people	20 people or more	80	1	less than 60 min	15% higher than now	10 people or more	Fewer than 20 people
10	1	9	80	2	61 to 120 min	5% higher than now	Fewer than 10 people	Fewer than 20 people	90	1	less than 60 min	10% higher than now	10 people or more	20 people or more
11	1	13	100	1	61 to 120 min	5% higher than now	10 people or more	20 people or more	60	2	less than 60 min	10% higher than now	Fewer than 10 people	Fewer than 20 people
12	1	19	90	1	60 min or less	20% higher than now	10 people or more	Fewer than 20 people	100	2	61 min to 2 hours	5% higher than now	Fewer than 10 people	20 people or more
13	1	23	80	2	60 min or less	15% higher than now	Fewer than 10 people	Fewer than 20 people	90	1	61 min to 2 hours	20% higher than now	10 people or more	20 people or more
14	1	26	90	1	61 to 120 min	10% higher than now	10 people or more	Fewer than 20 people	100	2	less than 60 min	15% higher than now	Fewer than 10 people	20 people or more
15	1	27	100	1	60 min or less	15% higher than now	10 people or more	20 people or more	60	2	61 min to 2 hours	20% higher than now	Fewer than 10 people	Fewer than 20 people
16	1	29	60	2	60 min or less	20% higher than now	Fewer than 10 people	20 people or more	80	1	61 min to 2 hours	5% higher than now	10 people or more	Fewer than 20 people

17	2	2	90	1	61 to 120 min	20% higher than now	Fewer than 10 people	20 people or more
18	2	5	60	2	61 to 120 min	20% higher than now	10 people or more	Fewer than 20 people
19	2	7	100	1	60 min or less	5% higher than now	Fewer than 10 people	Fewer than 20 people
20	2	10	100	1	61 to 120 min	15% higher than now	Fewer than 10 people	Fewer than 20 people
21	2	12	80	2	61 to 120 min	15% higher than now	10 people or more	20 people or more
22	2	17	60	2	60 min or less	10% higher than now	10 people or more	Fewer than 20 people
23	2	22	90	1	60 min or less	10% higher than now	Fewer than 10 people	20 people or more
24	2	30	80	2	60 min or less	5% higher than now	10 people or more	20 people or more

100	2	less than 60 min	5% higher than now	10 people or more	Fewer than 20 people
80	1	less than 60 min	5% higher than now	Fewer than 10 people	20 people or more
60	2	61 min to 2 hours	10% higher than now	10 people or more	20 people or more
60	2	less than 60 min	20% higher than now	10 people or more	20 people or more
90	1	less than 60 min	20% higher than now	Fewer than 10 people	Fewer than 20 people
80	1	61 min to 2 hours	15% higher than now	Fewer than 10 people	20 people or more
100	2	61 min to 2 hours	15% higher than now	10 people or more	Fewer than 20 people
90	1	61 min to 2 hours	10% higher than now	Fewer than 10 people	Fewer than 20 people

25	3	1	80	1	61 to 120 min	10% higher than now	10 people or more	Fewer than 20 people
26	3	3	60	1	61 to 120 min	5% higher than now	10 people or more	20 people or more
27	3	4	100	2	60 min or less	5% higher than now	Fewer than 10 people	20 people or more
28	3	11	60	1	60 min or less	15% higher than now	10 people or more	20 people or more
29	3	15	90	2	61 to 120 min	5% higher than now	Fewer than 10 people	Fewer than 20 people
30	3	16	100	2	61 to 120 min	10% higher than now	Fewer than 10 people	20 people or more
31	3	21	80	1	60 min or less	20% higher than now	10 people or more	Fewer than 20 people
32	3	32	90	2	60 min or less	15% higher than now	Fewer than 10 people	Fewer than 20 people

90	2	less than 60 min	15% higher than now	Fewer than 10 people	20 people or more
80	2	less than 60 min	10% higher than now	Fewer than 10 people	Fewer than 20 people
60	1	61 min to 2 hours	5% higher than now	10 people or more	Fewer than 20 people
80	2	61 min to 2 hours	20% higher than now	Fewer than 10 people	Fewer than 20 people
100	1	less than 60 min	10% higher than now	10 people or more	20 people or more
60	1	less than 60 min	15% higher than now	10 people or more	Fewer than 20 people
90	2	61 min to 2 hours	5% higher than now	Fewer than 10 people	20 people or more
100	1	61 min to 2 hours	20% higher than now	10 people or more	20 people or more

Appendix 2: Questionnaire used in the Pilot Survey

SURVEY FOR ROAD SAFETY IMPROVEMENTS IN NORTH CYPRUS

Date: ---------- Form No: ----------

Time started: ---------- Time ended: ----------

Introduction

We are conducting a survey to determine your perception of the safety of roads in North Cyprus. We will be asking you for information on a recent trip which was on roads in North Cyprus. The results can be used by the Government in their evaluations of alternative safety improvement projects, as well as in setting the appropriate tariff that reflect opportunity costs once the best alternatives are chosen. Your answers to this questionnaire will be completely confidential.

Naghmeh Niroomand
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Department of Economics
Eastern Mediterranean University

Section 1: Socio-demographic information

1. Where do you reside?

TRNC Abroad (please specify): ----------

[ ] 1. Lefkosa

[ ] 2. Gazimagusa

[ ] 3. Girne

[ ] 4. Güzelyurt

[ ] 5. Iskele

2. Gender of the respondent: [ ] 1. Male [ ] 2. Female

3. How old are you? Age: -------- Year of birth: ----------

4. Marital Status:

[ ] 1. Single (never married) [ ] 3. Divorced/Separated

[ ] 2. Married [ ] 4. Widowed

5. Do you work?

[ ] 1. Yes (go to question 6) [ ] 2. No (go to question 8)

6. What is the legal status of your work?

[ ] 1. Public [ ] 2. Private

7. What is your status at work?

[ ] 1. Employee (Salary, wages) [ ] 3. Self-employed
[ ] 2. Employer

8. What is the reason for not working?

[ ] 1. Retired [ ] 4. Household duties
[ ] 2. Student [ ] 5. Looking for a job, couldn't find one
[ ] 3. Found a job, waiting to start [ ] 6. Other (please specify): ……

9. Specify which of the following represent the total monthly income of all the members of your family (YTL) (including yourself):

[ ] 1. Less than 950	[ ] 6. 2,001-2,250	[ ] 11. 3,251-3,500
[ ] 2. 950-1,250	[ ] 7. 2,251-2,500	[ ] 12. 3,501-4,000
[ ] 3. 1,251-1,500	[ ] 8. 2,501-2,750	[ ] 13. 4,001-4,500
[ ] 4. 1,501-1,750	[ ] 9. 2,751-3,000	[ ] 14. 4,501-5,000
[ ] 5. 1,751-2,000	[ ] 10. 3,001-3,250	[ ] 15. 5001- 7000
[ ] 16. 7001- 9000	[ ] 17. 9001- 12000	[ ] 18. More than 12,000

10. Which of the following best describes the highest level of formal education you have attained/completed?

[ ] 1. No formal education [ ] 5. Technical school
[ ] 2. Primary school [ ] 6. University (2 year)
[ ] 3. Secondary school [ ] 7. University (4 year bachelor)
[ ] 4. College/high school [ ] 8. Post graduate

Section 2: Recent trip and perception of safety

11. Which of the following transportation systems are you used? Please choose one or more of the following actions.

[ ] 1.Own car [ ] 2. Someone else's car [ ] 3. Rent car
[ ] 4. Taxi [ ] 5. School Bus [ ] 6. Private Bus
[ ] 7.Van [ ] 8. Motorcycle

12. Where does your trip start? ----------

13. Where does your trip end? ----------

14. What was your average speed limit? ---------

15. About how long did this trip take? ---------- hr(s) -------- min(s)

16.1. Did your trip involve any breaks? [ ] 1. Yes [ ] 2. No [ ] 3. Sometimes

16.2. How many breaks did you take? ----------

16.3. How long were the breaks in total? --------hr(s) --------- min(s)

17.1. Are you or another member of your household paying for trip cost personally? (That is fuel and other associated cost of trip)
[ ] 1. Yes [ ] 2. Partly [ ] 3. No

17.2…….YTL/month

18. On average how many times do you use this road in a week? --------- times
19. Could you describe the percentage of time spent in the following traffic conditions?

1. Percentage of the trip is free flow (no main delay): ---------- %
2. Percentage of the trip involves minor delays due to a build up of traffic: ---------- %
3. Percentage of the trip involves major delays due to a build up of traffic: ---------- %
4. Percentage of the trip involves major delays due to a break down: ----------%
5. Percentage of the trip involves major delays due to an accident: ----------%

20. What is the purpose of your trip? choose one or more of the following actions.

[ ] 1. Education [ ] 2. Go to the airport

[ ] 3. Personal business [ ] 4. Shopping

[ ] 5.Travelling for work purposes [ ] 6.Travelling to/from work

[ ] 7.Visitting friends/relatives [ ] 8. Others

21. For your trip how many people in the following age groups are in the vehicle? Choose one or more.

[ ] 1. Under the 18 [ ] 2. 18-24 [ ] 3. 25-34 [ ] 4. 35-44

[ ] 5. 45-54 [ ] 6. 55-64 [ ] 7. 65 and over [ ] 8. Nobody

22. What is your opinion on the following matters on the roadways? Check the answer, which best describes your opinion for each of the following.

	Strongly Disagree (very unsafe)	Disagree (somewhat unsafe)	Neutral	Agree (somewhat safe)	Strongly Agree (very safe)
Feel relaxed while driving?					
Become sleepy while driving?					
Encounter law enforcement officials enforcing laws of the road?					
Feel less endangered driving after consuming alcohol?					
Eat while driving an automobile?					
Drive at a speed exceeding the posted speed limit?					
Use a cell phone while driving an automobile?					

Which one season do you consider to be the most dangerous season to be driving on the roadways?

[ ] 1.Spring [ ] 2. Summer [ ] 3. Fall [ ] 4.Winter

24. Which part of the road you travelled on would you described as (a) safest and (b) most danger?

a. Safest:
b. Most danger:

25. What made these parts of the road that you travelled the (a) safest and (b) most danger?

a. Safest:
b. Most danger:

26. The following nine statements related to your perceptions of safety rules and regulations. Please rate how much do you agree or disagree with each statement.

Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5)

	1	2	3	4	5
1. Many safety rules must be ignored to ensure traffic flow					
2. Sometimes it is necessary to bend the rule to ensure traffic flow					
3. Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.					
4. It is acceptable to speed when the other people are not involve					
5. It is acceptable to take chances when you are the only one exposed to the risk					
6. Safety rules are often complicated to be carried out in real life					
7. It is acceptable to break safety rules during the transport of people					
8. It is acceptable to break safety rules during the transport of goods					
9. It is more important to contribute to traffic condition than to always obey the laws					

27. The following statements related to ideas being discussed as possible ways to make roads safer. Please rate how effective you believe that ideas would be as a way to improve road safety.

	Very ineffective	Somewhat ineffective	Somewhat effective	Very effective
Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws				
Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk				
Requiring motorcyclists to wear a helmet				
Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license				
Enforcing speed limit laws through the use of speed camera				
Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring				

28. The following statements related to speed cameras in enforcing speed limit laws. Please rate how you believe that statements would be in support of using speed cameras in enforcing speed limit laws.

	Very unconvincing	Somewhat unconvincing	Somewhat convincing	Very convincing
These systems would reduce speeds and save lives				
These systems would cost less than human enforcement				
These systems would free law enforcement officials to prevent crimes and catch criminals				
These systems would be extremely				

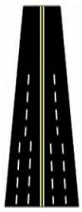
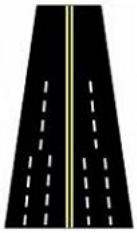
accurate identifying speeders				
No one has to worry about tickets if they simply obey the law				
Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed				
An independent company would monitor the system to ensure the government is not misusing the data being gathered				

29. The following statements against using speed cameras in enforcing speed limit laws. Please rate how you believe that statements would be as a reason to oppose the use of this system to enforce speeding laws.

	Very unconvincing	Somewhat unconvincing	Somewhat convincing	Very convincing
The government would invade privacy with the information they could gather				
These systems have made errors, so people would be treated unfairly				
It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers				
No one knows if these systems would actually save lives				
Drivers would find ways to evade the camera systems and avoid the law				
It would cost too many tax to buy, install and maintain all of the cameras				
Local government officials cannot be trusted to run this system well				
Using this system would take jobs away from hard-working law enforcement officials				

Section 3: Willingness to pay for improved road safety

30. Assume that you have to drive somewhere and that you can take two different routes. Below are details of two ways that you can drive. Please take a look at the characteristics of the routes and select the route that you will be more likely to choose.

Route A		Speed	Travel time	Route B		Speed	Travel time
1 lane each way (1 camera)			10 minutes	1 lane each way (no camera)			18 minutes
2 lanes each way (no camera)			8 minutes	2 lanes each way (1 camera)			9 minutes
3 lanes each way (1 camera)			8 minutes	3 lanes each way (no camera)			3 minutes
Total			26 minutes	Total			30 minutes
Time in free flow conditions			15 minutes	Time in free flow conditions			20 minutes
Time in slow down conditions			11 minutes	Time in slow down conditions			10 minutes
Running costs (fuel cost 10lit/100km)			35 YTL	Running costs (fuel cost 10lit/100km)			40 YTL
Toll costs			0 YTL	Toll costs			5 YTL
Death per year			4	Death per year			0
Severe, permanent injures per year			3	Severe, permanent injures per year			5
Injuries require hospitalization per year			11	Injuries require hospitalization per year			9
Minor injuries per year			24	Minor injuries per year			15

31. 1. Which routes would you use? [ ] 1. Route A [ ] 2. Route B [ ] 3. Current Rote

31. 2. If you could also chose not to travel:

[ ] 1. I would stick with the same route [ ] 2. I would choose not to travel

32. When you evaluate the previous question, to what extent did you take into the account the implications of your choice on the safety of others not travelling with you?

I focused on my own self interest — I focused only on the interests of others

1	2	3	4	5	6	7	8	9	10

33. Have you ever been in car accident in which someone -------- (please give a number……)

33.1. Was severely injured and has a permanent disability? [ ] 1. Yes [ ] 2. No

33. 2. Was hospitalized? [ ] 1. Yes [ ] 2. No

33. 3. Received minor injuries not requiring hospitalization? [ ] 1. Yes [ ] 2. No

34. Have anyone close to you ever been involved in a car accident in which someone:

34. 1. Died? [ ] 1. Yes [ ] 2. No

34. 2. Was severely injured and has a permanent disability? [ ] 1. Yes [ ] 2. No

34. 3. Was hospitalized? [ ] 1. Yes [ ] 2. No

34. 4. Received minor injuries not requiring hospitalization? [ ] 1. Yes [ ] 2. No

35. In your opinion, what are the three main reasons for accident when you have to drive somewhere on roads in North Cyprus?

Reason 1:

Reason 2:

Reason 3:

Thank you very much for your cooperation!

Appendix 3: Revised Questionnaire

SURVEY FOR ROAD SAFETY IMPROVEMENTS IN NORTH CYPRUS

Date: ---------- Form No: ----------

Time started: ---------- Time ended: ----------

Introduction

With Eastern Mediterranean university, we are conducting a survey to determine your perception of the safety of roads in North Cyprus. We will be asking you for information on a recent trip which was on roads in North Cyprus. The results can be used by the Government in their evaluations of alternative safety improvement projects, as well as in setting the appropriate tariff that reflect opportunity costs once the best alternatives are chosen. Your answers to this questionnaire will be completely confidential. There are no right and wrong answers. We are interested in your opinions.

Naghmeh Niroomand
PhD candidate,
Department of Ecomonics,
Eastern Mediterranean University

Section 1: Recent trip and perception of safety

1. Which of the following transportation systems did you use? Please choose one or more of the following actions.

[ ] 1.Own car [ ] 2. Someone else's car [ ] 3. Rent car
[ ] 4. Taxi [ ] 5. School Bus [ ] 6. Private Bus
[ ] 7.Van [ ] 8. Motorcycle

2. Where does your trip start? ----------
3. Where does your trip end? ----------
4. What was your average speed limit? ---------

5. About how long did this trip take? ---------- hr(s) -------- min(s)

6.1. Did your trip involve any breaks? [ ] 1. Yes [ ] 2. No [ ] 3. Sometimes

6.2. How many breaks did you take? ----------

6.3. How long were the breaks in total? --------hr(s) --------- min(s)

7.1. Are you or another member of your household paying for trip cost personally? (That is fuel and other associated cost of trip)

[ ] 1. Yes [ ] 2. Partly [ ] 3. No

7.2. …….YTL/month

8. On average how many times do you use this road in a week? --------- times

9. Could you describe the percentage of time spent in the following traffic conditions?

1. Percentage of the trip was free flow (no main delay): ---------- %
2. Percentage of the trip involved minor delays due to a build up of traffic: ---------- %
3. Percentage of the trip involved major delays due to a build up of traffic: ---------- %
4. Percentage of the trip involved major delays due to a break down: ----------%
5. Percentage of the trip involved major delays due to an accident: ----------%

10. What was the purpose of your trip? Choose one or more of the following actions.

[ ] 1. Education [ ] 2. Go to the airport
[ ] 3. Personal business [ ] 4. Shopping
[ ] 5.Travelling for work purposes [ ] 6.Travelling to/from work
[ ] 7.Visitting friends/relatives [ ] 8. Other (please specify):

11. For your trip how many people in the following age groups were in the vehicle? Choose one or more.

[ ] 1. Under the 18 (…..) [ ] 2. 18-24 (…..) [ ] 3. 25-34 (…..) [ ] 4. 35-44 (….)
[ ] 5. 45-54 (…..) [ ] 6. 55-64 (…..) [ ] 7. 65 and over (…..) [ ] 8. Nobody (….)

12. What is your opinion on the following matters on the roadways? Check the answer, which best describes your opinion for each of the following.

	Strongly Disagree (very unsafe)	Disagree (somewhat unsafe)	Neutral	Agree (somewhat safe)	Strongly Agree (very safe)
Feel relaxed while driving?					
Become sleepy while driving?					
Encounter law enforcement officials enforcing laws of the road?					
Feel less endangered driving after consuming alcohol?					
Eat while driving an automobile?					

Drive at a speed exceeding the posted speed limit?					
Use a cell phone while driving an automobile?					

13. Which one season does you consider being the most dangerous season to be driving on the roadways?

[ ] 1.Spring [ ] 2. Summer [ ] 3. Fall [ ] 4.Winter

14. The following nine statements related to your perceptions of safety rules and regulations. Please rate how much do you agree or disagree with each statement.
Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5)

	1	2	3	4	5
1. Many safety rules must be ignored to ensure traffic flow					
2. Sometimes it is necessary to bend the rule to ensure traffic flow					
3. Those who take chance and break the traffic rules are not necessary less secure than those doing everything by the book.					
4. It is acceptable to speed when the other people are not involve					
5. It is acceptable to take chances when you are the only one exposed to the risk					
6. Safety rules are often complicated to be carried out in real life					
7. It is acceptable to break safety rules during the transport of people					
8. It is acceptable to break safety rules during the transport of goods					
9. It is more important to contribute to traffic condition than to always obey the laws					

15. The following statements related to ideas being discussed as possible ways to make roads safer. Please rate how effective you believe that ideas would be as a way to improve road safety.

	Very ineffective	Somewhat ineffective	Somewhat effective	Very effective
Allowing law enforcement officials to stop and ticket drivers for failure to obey seatbelt laws				
Allowing law enforcement officials to stop drivers at checkpoints and ticket those driving drunk				
Requiring motorcyclists to wear a helmet				
Requiring new drivers to gain experience and skills gradually over time in low-risk environments before giving them a full drivers license				
Enforcing speed limit laws through the use of speed camera				
Provide easy access to searchable online maps to show drivers where and how fatal crashes have been occurring				

16. The following statements related to speed cameras in enforcing speed limit laws. Please rate how you believe that statements would be in support of using speed cameras in enforcing speed limit laws.

	Very unconvincing	Somewhat unconvincing	Somewhat convincing	Very convincing
These systems would reduce speeds and save lives				
These systems would cost less than human enforcement				
These systems would free law enforcement officials to prevent crimes and catch criminals				
These systems would be extremely accurate identifying speeders				
No one has to worry about tickets if they simply obey the law				
Speeding kills thousands of innocent people, so current methods are not effective enough and new approaches are needed				
An independent company would monitor the system to ensure the government is not misusing the data being gathered				

17. The following statements against using speed cameras in enforcing speed limit laws. Please rate how you believe that statements would be as a reason to oppose the use of this system to enforce speeding laws.

	Very unconvincing	Somewhat unconvincing	Somewhat convincing	Very convincing
The government would invade privacy with the information they could gather				
These systems have made errors, so people would be treated unfairly				
It is more important to preserve personal liberty for all drivers than it is to save lives for comparatively few drivers				
No one knows if these systems would actually save lives				
Drivers would find ways to evade the camera systems and avoid the law				
It would cost too many tax to buy, install and maintain all of the cameras				
Local government officials cannot be trusted to run this system well				
Using this system would take jobs away from hard-working law enforcement officials				

Section 2: Willingness to pay for improved road safety

18. Assume that you have to drive somewhere and that you can take two different routes. Below are details of two ways that you can drive. Please take a look at the characteristics of the routes and select the route that you will be more likely to choose.

	Route A	Route B	Current Route
Speed camera (per lane)	1	2	Neither route A nor route B: I prefer to stay with my current route
Average speed limit (km/h)	90	80	
Travel time (min)	60 min or less	61 to 120 min	
Running costs (TL)	20%	10%	
Fatal crashes (per year)	Fewer than 10 people	10 people or more	
Injuries (per year)	20 people or more	Fewer than 20 people	

(*Go to the choice sets and show the respondent 8 choice sets according to the version assigned for him/her.)*

18. 1. Which routes would you use?

	Route A	Route B	Current Route	
1. SET				VERSION ……..
2. SET				
3. SET				
4. SET				
5. SET				
6. SET				
7. SET				
8. SET				

18. 2. If you could also chose not to travel:

[ ] 1. I would stick with the same route [ ] 2. I would choose not to travel

19. When you evaluate the previous question, to what extent did you take into the account the implications of your choice on the safety of others not travelling with you?

I focused on my own self interest — I focused only on the interests of others

1	2	3	4	5	6	7	8	9	10

20. Have you ever been in car accident in which someone ……. (Please give a number…..)

20. 1. Was severely injured and has a permanent disability? [ ] 1. Yes [ ] 2. No

20. 2. Was hospitalized? [ ] 1. Yes [ ] 2. No

20. 3. Received minor injuries not requiring hospitalization? [ ] 1. Yes [ ] 2. No

21. Have anyone close to you ever been involved in a car accident in which someone:

21. 1. Died? [ ] 1. Yes [ ] 2. No

21. 2. Was severely injured and has a permanent disability? [ ] 1. Yes [ ] 2. No

21. 3. Was hospitalized? [ ] 1. Yes [ ] 2. No

21. 4. Received minor injuries not requiring hospitalization [ ] 1. Yes [ ] 2. No

Section 3: Socio-demographic information

24. Where do you reside?

TRNC

[ ] 1. Lefkosa

[ ] 2. Gazimagusa

[ ] 3. Girne

[ ] 4. Güzelyurt

[ ] 5. Iskele

25. Gender of the respondent: [ ] 1. Male [ ] 2. Female

26. How old are you? Age: --------

27. Marital Status:

[ ] 1. Single (never married) [ ] 3. Divorced/Separated

[ ] 2. Married [ ] 4. Widowed

28. Do you work?

[ ] 1. Yes (go to question 6) [ ] 2. No (go to question 8)

29. What is the legal status of your work?

[ ] 1. Public [ ] 2. Private

30. What is your status at work?

[ ] 1. Employee (Salary, wages) [ ] 3. Self-employed

[ ] 2. Employer

31. What is the reason for not working?

[ ] 1. Retired [ ] 4. Household duties

[ ] 2. Student [ ] 5. Looking for a job, couldn't find one

[ ] 3. Found a job, waiting to start [ ] 6. Other (please specify):

32. Specify which of the following represent the total monthly income of all the members of your family (YTL) (including yourself):

[ ] 1. Less than 1300	[ ] 4. 4,001- 5,000	[ ] 7. 7,001-8,000	[ ] 10. 10,001-11,000
[ ] 2. 1,301-2,000	[ ] 5. 5,001- 6,000	[ ] 8. 8,001-9,000	[ ] 11. 11,001- 12,000
[ ] 3. 2,001- 4,000	[ ] 6. 6,001-7,000	[ ] 9. 9,001-10,000	[ ] 12. More than 12,000

33. Which of the following best describes the highest level of formal education you have attained/completed?

[ ] 1. No formal education [ ] 5. Technical school

[ ] 2. Primary school [ ] 6. University (2 year)

[ ] 3. Secondary school [ ] 7. University (4 year bachelor)

[ ] 4. College/high school [ ] 8. Post graduate

Please rate the quality of the interview based on the concentration of the person to be interviewed, attentiveness to the questions, and number of questions answered:

1	2	3	4	5
Very poor [ ]	Poor [ ]	Fair [ ]	Good [ ]	Very good [ ]

Thank you very much for your cooperation!

Appendix 4: MNL Model Specifications (LIMDEP Version 10)

Constants Only Model

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,d,ct$

Nlogit;

Lhs=choice;

choices=1,2,3;

model:u(1,2)=asc$

Model 1: U (1,2)= asc+Bsl*sl+Bsc*sc+Bt*t+ Binj*inj+ Bd*d +Bct*c

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,ct$

Nlogit;

Lhs=choice;

choices=1,2,3;

Model: U(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+ Binj*inj+ Bd*d

+Bct*ct/U(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +Bct*ct$

Model 2: U (1,2)=asc+Blsl*lsl+Bsc*sc+Bt*t+ Binj*inj+ Bd*d +Bct*ct

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,ct$

Create;lsl=log(sl)$

Nlogit;

Lhs=choice;

choices=1,2,3;

Model: U(1,2)=asc+Blsl*lsl+Bsc*sc+Bt*t+ Binj*inj+ Bd*d

+Bct*ct/U(3)=Blsl*lsl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +Bct*ct$

Model 3: U (1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+ Binj*inj+ Bd*d +Blct*lct

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,ct$

Create;lct=log(ct+1)$

Nlogit;

Lhs=choice;

choices=1,2,3;

Model: U(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+ Binj*inj+ Bd*d

+Blct*lct/U(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +Blct*lct$

Model 4: U (1,2)=asc+Blsl*lsl+Bsc*sc+Bt*t+ Binj*inj+ Bd*d +Blct*lct

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,ct$

Create;lsl=log(sl)$

Create;lct=log(ct+1)$

Nlogit;

Lhs=choice;

choices=1,2,3;

Model: U(1,2)=asc+Blsl*lsl+Bsc*sc+Bt*t+ Binj*inj+ Bd*d +Blct*lct

/U(3)=Blsl*lsl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +Blct*lct$

Model 5: U (1,2)=asc+Blsl*lsl+Blsc*lsc+Bt*t+ Binj*inj+ Bd*d +Blct*lct

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,ct$

Create;lsl=log(sl)$

Create;lct=log(ct+1)$

Create;lsc=log(sc)$

Nlogit;

Lhs=choice;

choices=1,2,3;

Model: U(1,2)=asc+Blsl*lsl+Blsc*lsc+Bt*t+ Binj*inj+ Bd*d +Blct*lct

/U(3)=Blsl*lsl+Blsc*lsc+Bt*t+Binj*inj+ Bd*d +Blct*lct$

Appendix 5: Hausman Test

IAS = 1

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,ct$

Nlogit;

Lhs=choice;

choices=1,2,3;

Model:U(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +

Bct*ct/U(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d + Bct*ct$

Nlogit;Ias=1;Lhs=choice; choices=1,2,3; Model:U(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +

Bct*ct/U(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d + Bct*ct$

IAS = 2

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,ct$

Nlogit;

Lhs=choice;

choices=1,2,3; Model:U(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +

Bct*ct/U(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d + Bct*ct$

Nlogit;Ias=2;Lhs=choice; choices=1,2,3; Model:U(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +

Bct*ct/U(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d + Bct*ct$

IAS = 3

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=12;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,ct$

Nlogit;

Lhs=choice;

choices=1,2,3;

Model:U(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +

Bct*ct/U(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d + Bct*ct$

Nlogit;Ias=3;Lhs=choice; choices=1,2,3; Model:U(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d +

Bct*ct/U(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+ Bd*d + Bct*ct$

Appendix 6: Mixed Logit Model (NLogit version 5.0)

reset$

Read;file=F:\code3.txt;

Nobs=10000;Nvar=14;Names=id,ver,choiceset,alti,noalt,choice,sl,sc,t,inj,d,ct,slage,sledu$

Create;lct=log(ct+1)$

calc;ran(12345)$

nlogit;

lhs=choice;

choices=1,2,3;

Halton;rpl;

fcn=Bsl(t,0.5),Bt(t,0.5),Bsc(t,0.5),Binj(t,0.5);pts=20;

par;model:u(1,2)=asc+Bsl*sl+Bsc*sc+Bt*t+Binj*inj+Bd*d+Blct*lct+Bslage*slage+Bsledu*sledu/u

(3)=Bsl*sl+Bsc*sc+Bt*t+Binj*inj+Bd*d+Blct*lct+ Bslage*slage+Bsledu*sledu $

wald;fn1=asc/Blct;fn2=Bsl/Blct;fn3=Bsc/Blct;fn4=2*(Bt/Blct);fn5=2*(Binj/Blct;fn6=2*(Bd/Blct)$