56TH CIECA CONGRESS
DUBAI 2024

RTA

Using Telematics for Monitoring & Improving Driver Safety Behaviour

George Yannis, Professor

Virginia Petraki, Research Associate

National Technical University of Athens

Outline

56TH CIECA CONGRESS
DUBAI 2024

- 01 Background
- 02 The Objective
- 03 Methodology
- 04 Road Safety Benefits from Telematics
- 05 Eco Benefits from Telematics
- 06 Telematics Preferences Survey
- 07 Socio-economic Impacts
- 08 CBA Results

Background & Objective

Background
The Problem

- Climate change, environmental degradation, energy use and road safety are **key existential threats** to Europe and the world that should be addressed
- **Road safety** is a major public health issue, as crashes are the leading cause of death until 29 years globally
- Road transport is responsible for most transport fatalities, with an annual **1,35 million road traffic deaths** worldwide
- Transport is responsible for about a quarter of the EU's total **CO_2 emissions**, of which 71.7% come from road transport
- **Driving behavior** is considered as one of the most critical factors for road safety, energy consumption and the environment

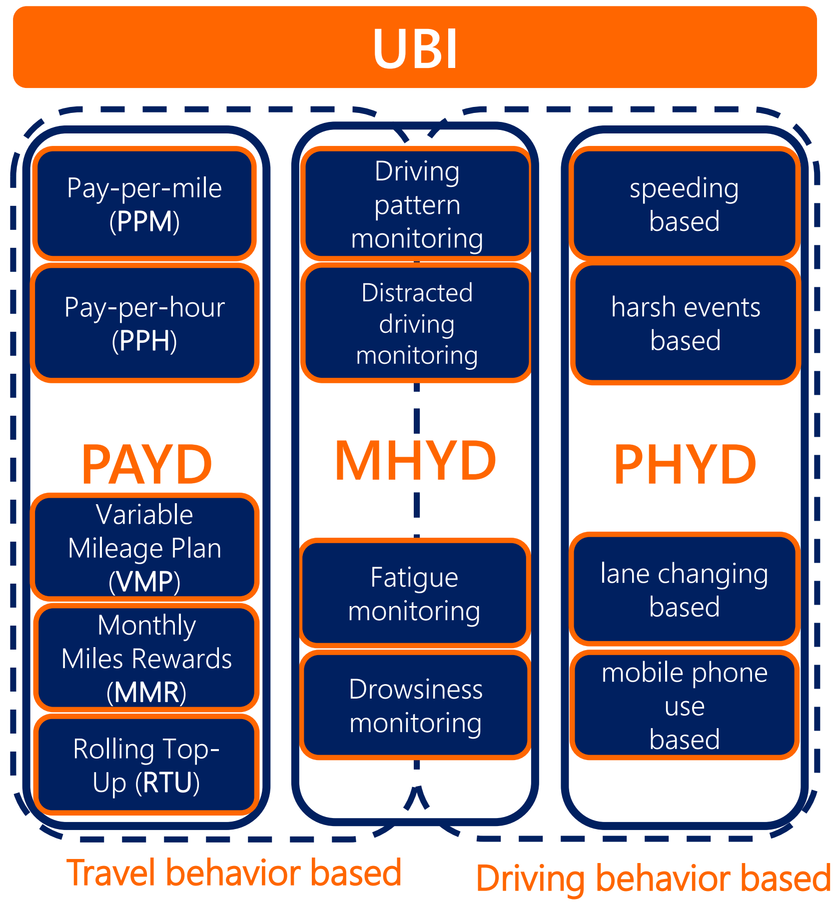
Background
A Solution

- The rise of **smartphones, sensors and connected objects** offers more and more transport data
- The interpretation of these data can be made possible thanks to progress in **computing power**, **data science** and **artificial intelligence**
- **Driving telematics** utilizes Artificial Intelligence and these data to monitor, evaluate and improve driver behavior, promoting
  - safe driving,
  - environmentally friendly driving and
  - energy efficient driving
- Driver feedback is delivered through the **Driver Performance Telematics** (vehicle or smartphone)
  - Real-time feedback
  - Safety performance star rating

Background

Telematics Integration in Insurance Practices

- The widespread adoption of telematics through insurance products holds the potential for significant **benefits to society** by reducing road crashes and the environmental impact
- The **traditional charging policy** of insurance companies, which is a fixed price, has been regarded as unfair and inadequate
- The **idea of UBI** is that a driver's behavior is monitored directly using telematics, allowing insurance companies to align driving behaviors with premium rates
- UBI can have **several variants**
  - Pay-As-You-Drive (**PAYD**): the parameters that affect the insurance charging is the driven distance or time (hours, days)
  - Pay-How-You-Drive (**PHYD**): uses the motivation for safer driving for charging calculation based on the driver behavior
  - Manage-How-You-Drive (**MHYD**): drivers are provided with a real-time data so that drivers can manage and moderate their driving



The Objectives

The objectives of this work are:

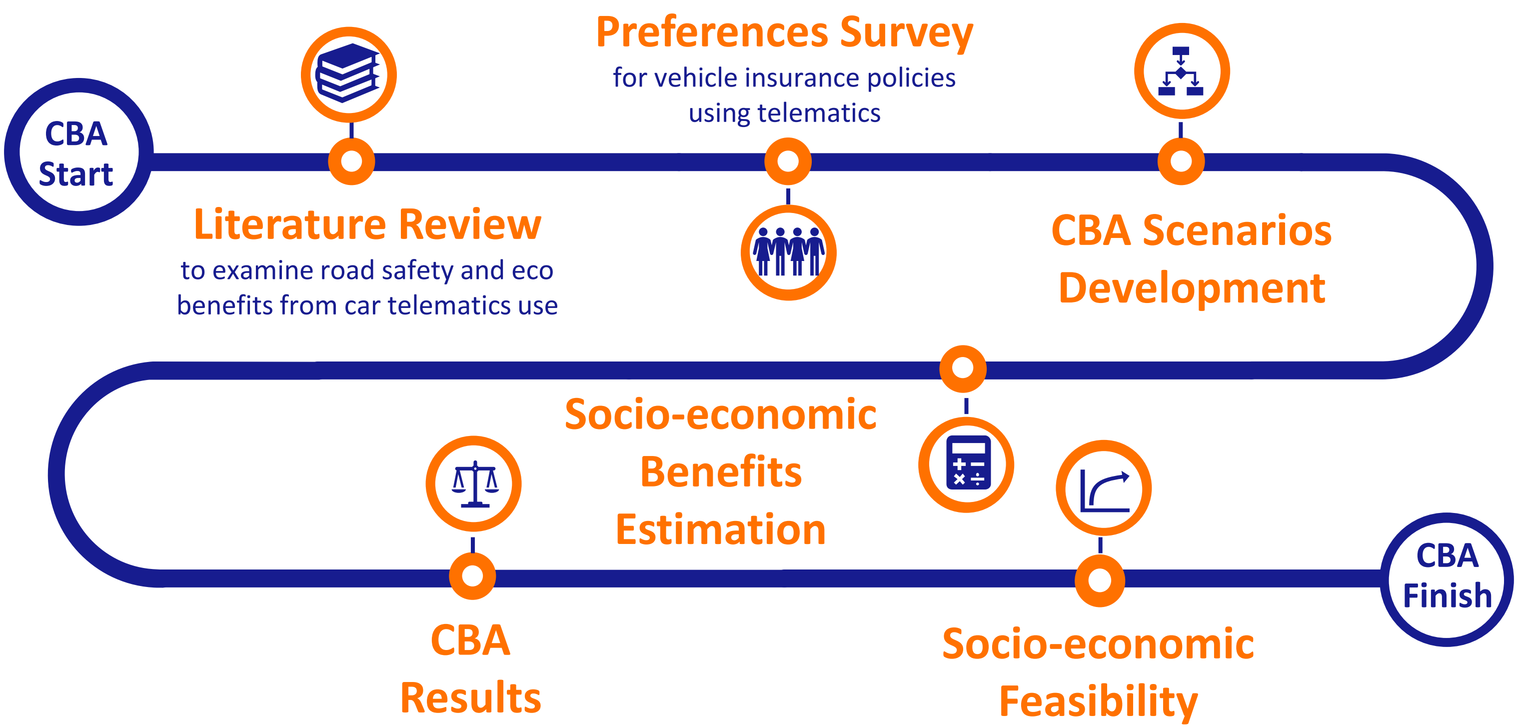
1 to investigate **the potential of driving telematics technology** in promoting safe and eco driving behavior

2 to investigate the **socio-economic feasibility** of the provision of financial incentives and benefits by the State for **vehicle insurance policies using telematics**

Methodology

Methodology

A **social Cost Benefit Analysis (CBA)** is conducted, focusing on the provision of financial incentives and benefits in the form of a **"Safe Pass" Voucher** by the Greek State for passenger car insurance policies using telematics



Social CBA

56TH CIECA CONGRESS
DUBAI 2024

- Social CBA is becoming a necessary **economic appraisal tool** used to evaluate transport policies from a social welfare point of view

- The CBA requires the comparison of at least two main **Scenarios**:
  - **Scenario 0** (S0): do-nothing
  - **Alternative Scenario**: policy implementation

- For a socio-economically sustainable policy, the following **criteria** must be met:
  - Net Present Value (NPV) **>0**
  - Internal Rate of Return (IRR) **>social discount rate**
  - Benefit to Cost ratio (B/C) **>1**

The following benefits or costs must be considered to **capture the impact on the society**:

Road Casualties

Vehicle Operating Costs

Trave Time

Air pollution & Greenhouse gas emissions

“Safe Pass” Voucher

56TH CIECA CONGRESS
DUBAI 2024

- **Provision of a Safe Pass Voucher** (of at least of €50.00 in value) for drivers of passenger vehicles to be used in conjunction with every purchase of a telematics insurance policy

- The Safe Pass Voucher will help to achieve:

- **maximum demand** for this innovative insurance product, making it tempting
- **maximum uptake** in a reasonable period of time, making it attractive

56TH CIECA CONGRESS
DUBAI 2024

Societal Benefits from Telematics

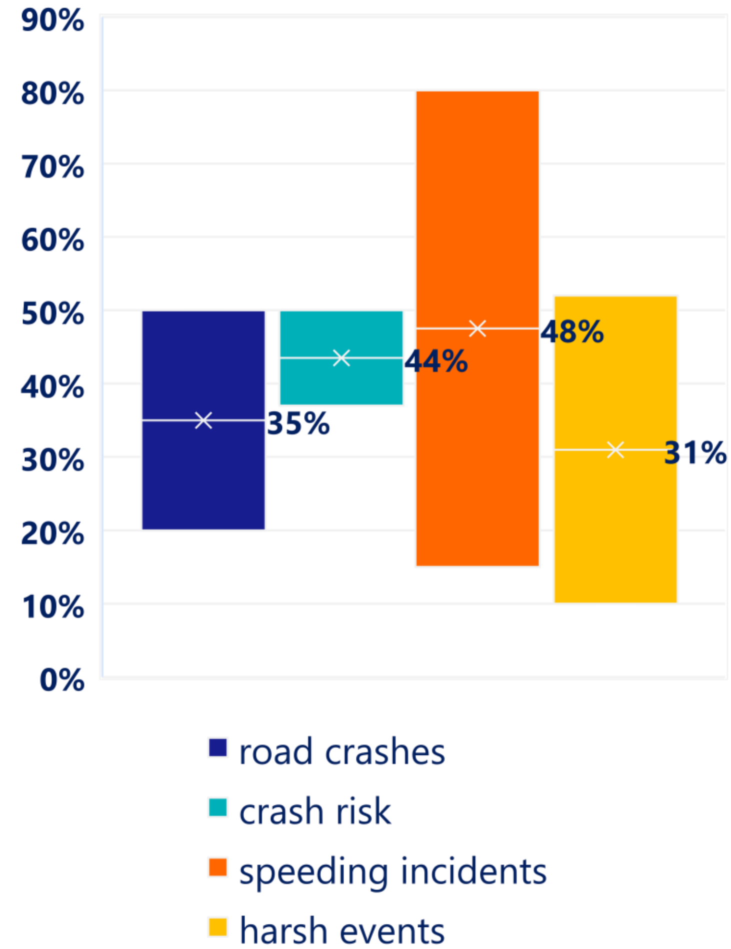
Road Safety Benefits

56TH CIECA CONGRESS DUBAI 2024

- There is **little research** on the quantification of the impact of telematics on road safety in terms of before/after feedback provision to drivers

- After a thorough literature review regarding the **quantification of the impact** of telematics on road safety, the following key findings were observed:
  - **Road crash reductions** varying from 20% - 50%
  - **Crash risk reductions** varying from 37% - 50%
  - **Speeding incident reductions** varying from 15% - 80%
  - **Harsh event reductions** varying from 10% - 52%

- Also, **network level studies** have been developed to proactively assess road safety using harsh driving events



Eco Benefits

- Improving driver behavior using telematics undoubtedly has a positive impact on the **environment and energy efficiency**

- **Safe driving implies eco-driving** which is expressed in lower fuel consumption, and a reduction in CO_2 emissions

- Several international studies which were based on data obtained from physical driving experiments lasting from a few weeks to 2 years reported a **reduction in fuel consumption of 3% - 15%** after using some type of telematics while driving

Preferences Survey

Preferences Survey Structure

56TH CIECA CONGRESS
DUBAI 2024

- A questionnaire was developed to collect the necessary data for the social CBA regarding the **demand of car insurance using telematics**

- >1,000 questionnaires were distributed, from which responses from **897 car drivers (72%)** were finally used

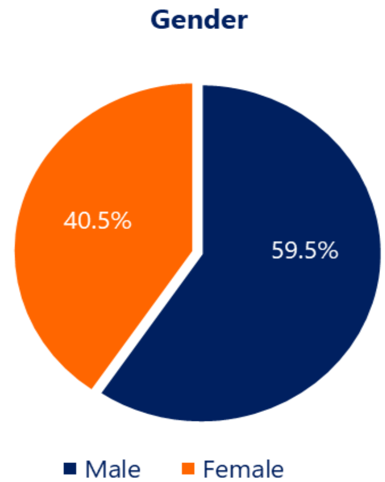
- The questionnaires have **3 thematic sections**

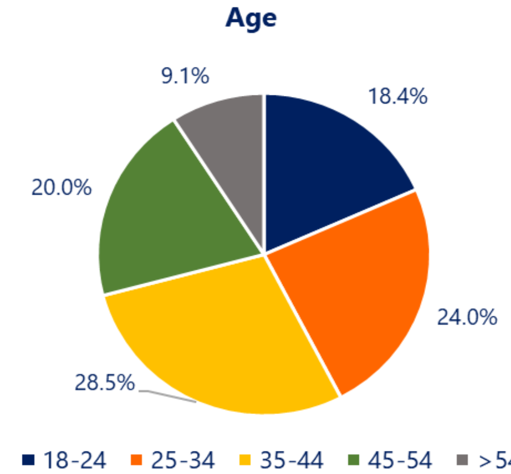
1st Section	2nd Section	3rd Section
Participants' driving experience and travel habits	Respondents were gradually introduced to the subject of the survey by answering questions about vehicle insurance policies which use telematics	The core section which includes the question on the acceptability of selecting a car insurance using telematics

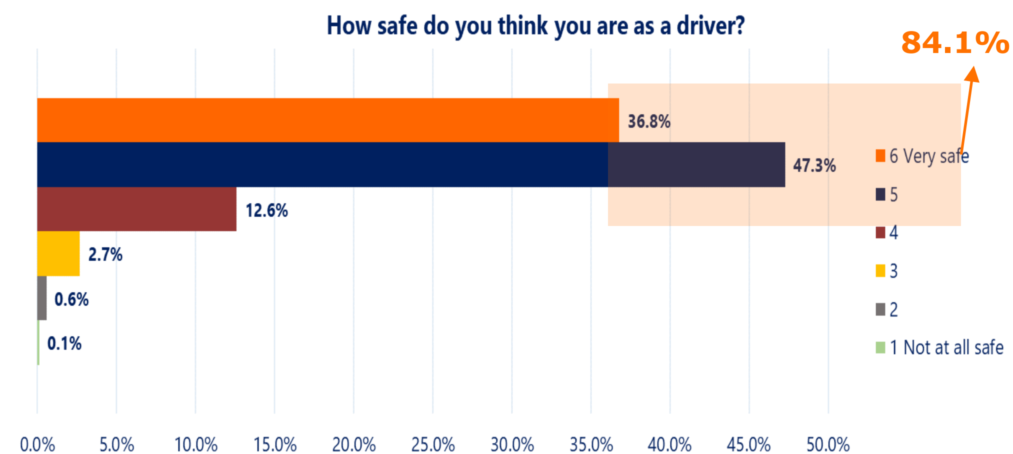
Preferences Survey Results

1st and 2nd Sections

- As for the respondents' travel habits, the majority of the sample states that **they drive daily** (74.6%)
- Most respondents believe that they are **sufficiently to very safe drivers** while only 0.7% of drivers believe that they are fairly to totally unsafe drivers
- Given the prevailing driving behavior in Greece and the country's 20th position in the European road safety ranking, drivers tend to **overestimate** their skills and perceive their driving behavior as safer than it truly is



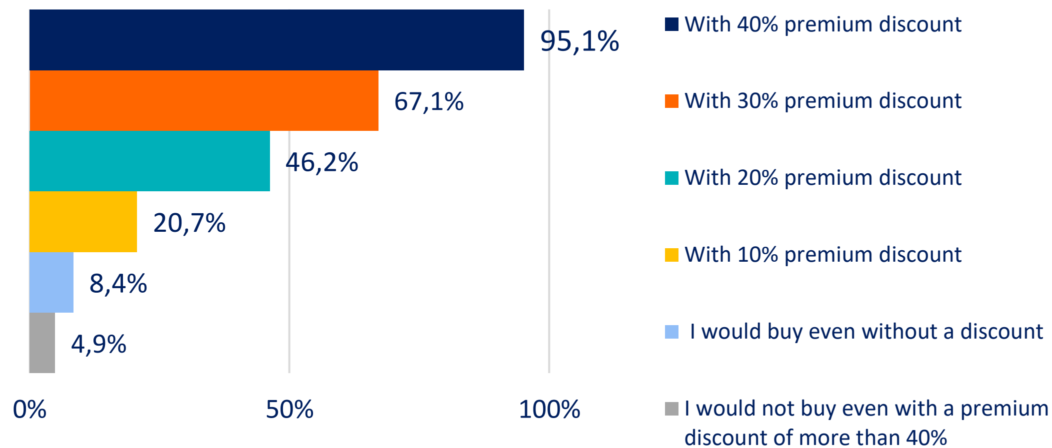




Preferences Survey Results
3rd Section

- A linear regression **mathematical model** is developed to predict the sensitivity of the acceptability of discounts on telematics premiums
- The **acceptance level** for insurance policies using telematics increases as the financial incentives for vehicle insurance increase
- For a 10% **equivalent premium discount**, 20.7% of drivers would buy insurance policy using telematics, whereas for a 40% discount the specific percentage amounts to 95.1%

What is the minimum discount (or other financial benefit) which would lead to you buying vehicle insurance which uses telematics?
Note: installation of an app is required for trip recording



	Estimate	Std. Error	t value	Pr (>|t|)	
(Intercept)	0.035	0.021	2.673	0.108	
Discount	2.203	0.085	26.035	<2e-16	***

Social CBA

Scenarios Development

56TH CIECA CONGRESS
DUBAI 2024

4 alternative Scenarios with different provided financial incentives in the form of a "Safe Pass" Voucher, are investigated

0€

50€

55€

60€

70€

S0
S0 represents the **do-nothing situation**

S1
700.000
Safe Passes/year

S2
1.500.000
Safe Passes/year

S3
2.500.000
Safe Passes/year

S4
3.500.000
Safe Passes/year

56TH CIECA CONGRESS
DUBAI 2024

Socio-economic Impact Estimation

For the Environment

Fuel Consumption

- The average annual fuel consumption for Greek passenger car fleet by 2030 is considered, based on **EU targets**
- The **fuel consumption effect** is estimated, considering the fuel cost, the annual veh-km, and the average fuel consumption
- An average **5% reduction in fuel consumption** is assumed, based on literature

Environment

- The **environmental effect** is computed considering the annual veh-km, the CO_2 emissions per veh-km, and the social cost of CO_2 (€/ton)
- An average **5% reduction in CO_2 emissions** is assumed, based on the international literature

Socio-economic Impact Estimation

For the Society

Road Safety

- **Injury crash statistics** in Greece are considered, including road fatalities, severe and light injured road users in the category passenger car
- The **social costs** per road fatality, severe and light injury are valued at 2,148,034€, 273,574€, and 51,373€, respectively, in Greece
- An average **30% reduction in road casualties** is assumed, based on literature

Travel Time

- The **travel time effect** is estimated considering the insured cars, the car occupancy rate of 1.2, the annual travel time, & the value of time (VOT) at 5.6€/hour
- The **expected increase in travel time**, attributed to the reduced speed resulting from enhanced driving behavior, is cautiously estimated at 2%

Socio-economic Impact

56TH CIECA CONGRESS
DUBAI 2024

For the Environment

121-636
million lt
fuel savings up to 2030

0.3-1.5
million tons
CO_2 savings up to 2023

For the Society

75-364
less road fatalities up to 2030

62-307
less serious injuries up to 2030

1,331-6,560
less light injuries up to 2030

CBA Results

56TH CIECA CONGRESS DUBAI 2024

Scenario	S1	S2	S3	S4
Safe Pass	**€50**	**€55**	**€60**	**€70**
State Grant (2024-2030)	**225 million €**	**533.5 million €**	**960 million €**	**1.6 billion €**
2024	15.0 million €	38.5 million €	60.0 million €	105.0 million €
State Grant (2025-2030)	35.0 million €	82.5 million €	150.0 million€	245.0 million €
Change in socio-economic indicators (2024 - 2030)				
Light Injuries	-1,331	-2,841	-4,669	-6,560
Severe Injuries	-62	-131	-219	-307
Fatalities	-75	-158	-261	-364
Fuel consumption (litres)	-121 million	-270 million	-450 million	-636 million
CO_2 emissions (tons)	-0.3 million	-0.6 million	-1.0 million	-1,5 million
Benefits Present Value	**320 million €**	**685 million €**	**1,134 million €**	**1,590 million €**
Net Present Value	**100 million €**	**164 million €**	**197 million €**	**55 million €**
Internal Rate of Return	**52.7%**	**35.3%**	**24.3%**	**4.8%**

Note: 2024 indicators multiplied by 75% due to the policy's application post the first quarter.

CBA Results – S1

56TH CIECA CONGRESS
DUBAI 2024

In this table, an **overview of Scenario S1** results is presented.

Year	State Grant (€)	Number of Safe Passes	Light Injuries	Serious Injuries	Fatalities	Fuel Consumption (liters)	CO_2 emissions (tons)
2024	15,000,000 €	300,000	-73	-3	-5	-6,911,384	-16,428
2025	35,000,000 €	700,000	-223	-10	-13	-20,806,814	-49,396
2026	35,000,000 €	700,000	-218	-10	-12	-20,079,617	-47,502
2027	35,000,000 €	700,000	-213	-10	-12	-19,350,171	-45,642
2028	35,000,000 €	700,000	-207	-10	-12	-18,664,435	-43,907
2029	35,000,000 €	700,000	-201	-10	-11	-18,072,774	-42,410
2030	35,000,000 €	700,000	-196	-9	-10	-17,405,791	-41,031
Total	**225,000,000 €**	**4,500,000**	**-1,331**	**-62**	**-75**	**-121,290,986**	**-286,317**

Conclusions & Open issues

56TH CIECA CONGRESS
DUBAI 2024

Conclusions

- Addressing road safety, climate change, and energy consumption is of paramount importance as **urgent global challenges**
- This can be achieved for the transport sector via the **promotion and wide use of driving telematics**
- The **insurance sector** can boost the adoption of driving telematics by integrating them into their products, such as UBI schemes
- **State** can also play a role in promoting telematics usage by offering financial incentives and benefits for vehicle insurance policies using telematics

Conclusions

- Telematics fosters **safer and eco-friendly driving habits**
- **Social CBA results** highlight that all Scenarios are socio-economically feasible
  - NPV > 0
  - 5% < IRR < 53%
- In terms of **socio-economic performance**, S3 involving a Safe Passe with value of €60, is the preferred one as it demonstrates the highest NPV and a high IRR index

Open Issues

- The thorough investigation of the effectiveness of telematics-driven post-trip interventions, and how they may be **optimized** for maximum net impacts
- UBI telematics systems may require **'cold start' inputs** for new users or for when an intervention or road safety measure is being implemented for the first time in their road network, but previous knowledge may exist
- **Feasible transferability** methods need to be set in place for effective UBI

56TH CIECA CONGRESS
DUBAI 2024

THANK YOU

George Yannis, Professor