

International ESRA Conference

Traffic Safety Culture and Performance Indicators

April 21, 2022, ONLINE

Correlations of multiple rider behaviors with self-reported attitudes, perspectives on traffic rule strictness and social desirability



Yannis G., Nikolaou D., Ziakopoulos A.
National Technical University of Athens



Presentation outline

- ▶ Background
- ▶ Objective and Research Questions
- ▶ ESRA2 data
- ▶ Descriptive Statistics
- ▶ SEM overview and results
- ▶ Concluding remarks
- ▶ Key recommendations

Background (1/2)

- ▶ Mopeds and motorcycles (PTWs) form an **important component of the transport system**, as they offer increased mobility at a reduced cost and a special sense of pleasure.
- ▶ However, riding a PTW is much **more dangerous** than using other motor vehicles.
- ▶ PTWs accounted for **18%** of overall road fatalities in EU countries in 2019 (EC, 2021).
- ▶ Globally, users of motorised two- and three- wheelers represent **28%** of all road fatalities (WHO, 2018).
- ▶ These **alarming numbers** of potentially avoidable deaths highlight the need for increased attention to motorcycles and mopeds.



Background (2/2)

- ▶ **Vehicle age** and the **lack of helmet use** have been found to have an impact on increased crash severity (Ziakopoulos et al., 2018).
- ▶ **Behavioural issues** play a major role in PTW crashes.
- ▶ **Risk taking and sensation seeking** are typical behaviours of riders that are usually expressed through:
 - ▶ speeding
 - ▶ disobeying traffic signals and signs
 - ▶ ignoring overtaking restrictions or pedestrian crossings
 - ▶ maintaining short distances with the vehicles ahead of them
- ▶ PTW users' behaviour is related to **age and riding exposure**. PTW riders that speed appear to be more often younger and male (Vlahogianni et al., 2012).



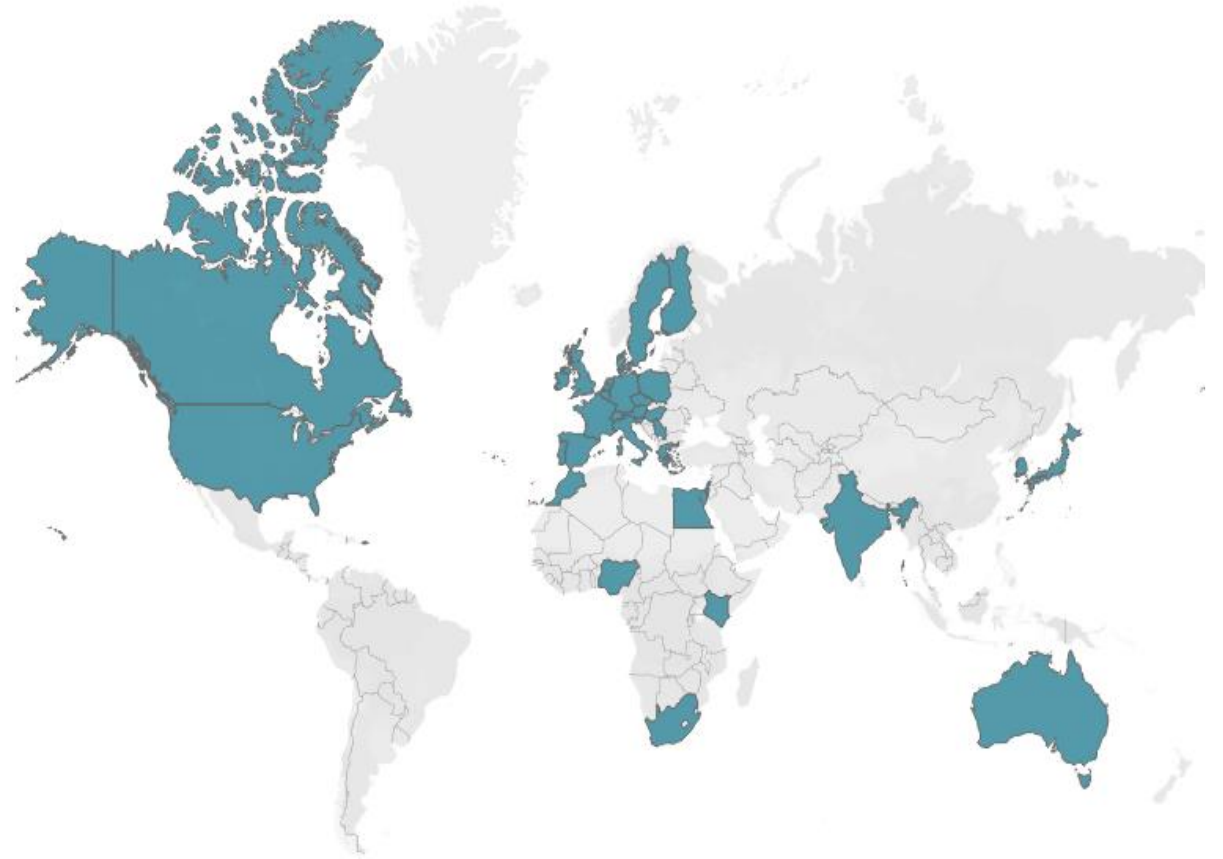
Objective and Research Questions

- Present a **thorough, overarching structure of relationships** correlating various unsafe stated PTW rider behaviors (riding after alcohol consumption, speeding, helmet use and texting) with several self-reported attitude parameters and factors regarding rider perspectives on traffic rule strictness and social desirability.
- Main **research questions** formulated:
 1. Can the overarching structure of relationships correlating various unsafe stated PTW rider behaviors be appropriately captured via Structural Equation Modelling (SEM)?
 2. Can the self-declared inputs of PTW riders be converted to meaningfully represent unobserved theoretical constructs expressing (i) demographic profiles, (ii) attitudes towards risk factors, (iii) positive attributes towards road safety, and (iv) social desirability?
 3. Are the four self-reported unsafe PTW behaviors influenced by self-reported attitude parameters, rider perspectives on traffic rule strictness and social desirability, and with each other?"



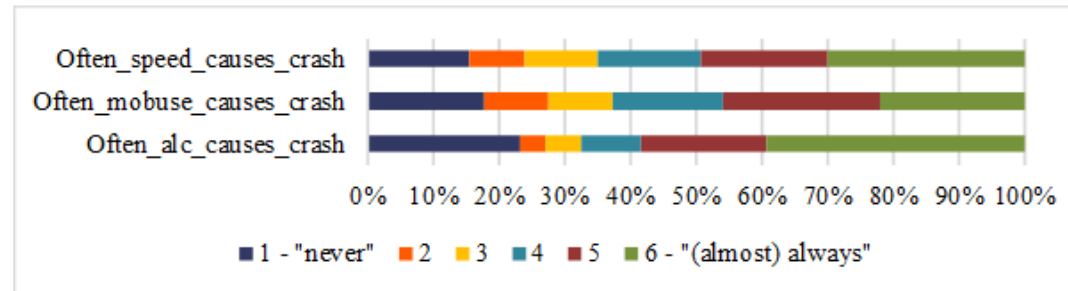
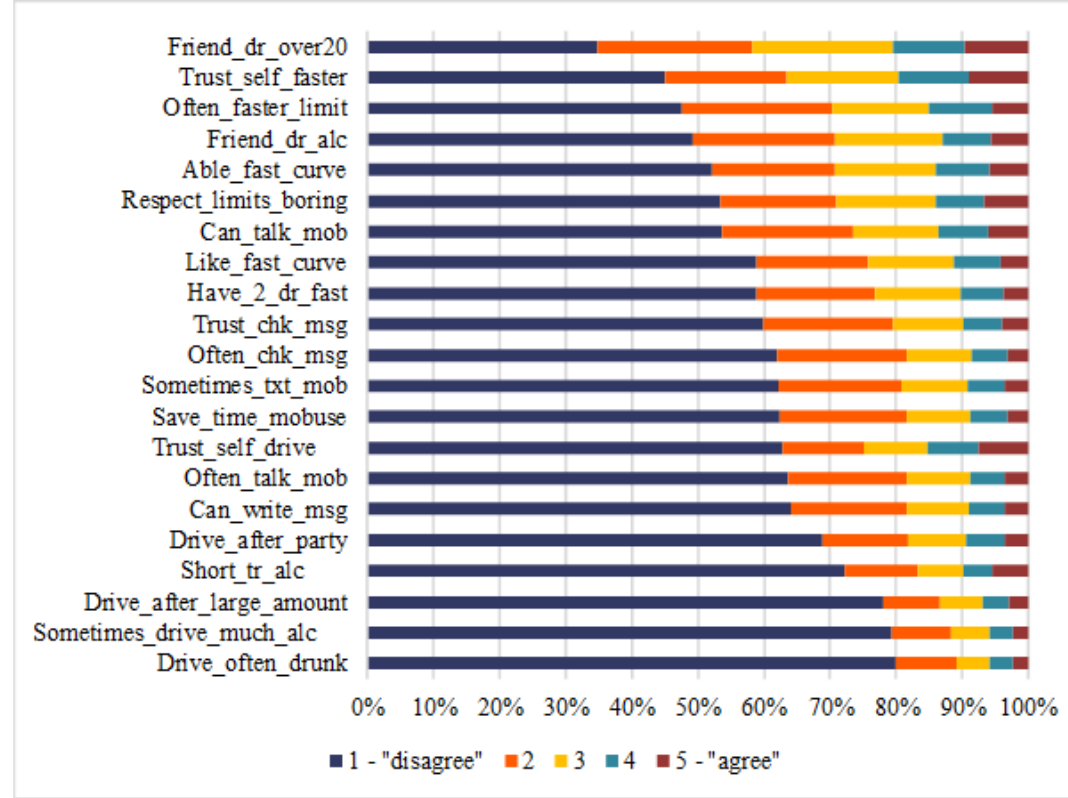
ESRA2 data

- ▶ The present research is based on the first iteration of the ESRA2 survey spanning **32 countries** (20 European, 2 North American, 5 Asian-Oceanian and 5 African) in 2018.
- ▶ The sample includes **5,958 respondent riders** from the 32 participant countries (male: 66%, female: 34% - mean age: 38.2 y.o., standard deviation of age: 14.5 years).
- ▶ They are all riders who have stated in the survey that they ride a moped (electric or conventional) or a motorcycle (electric or conventional) **at least a few days a month**.



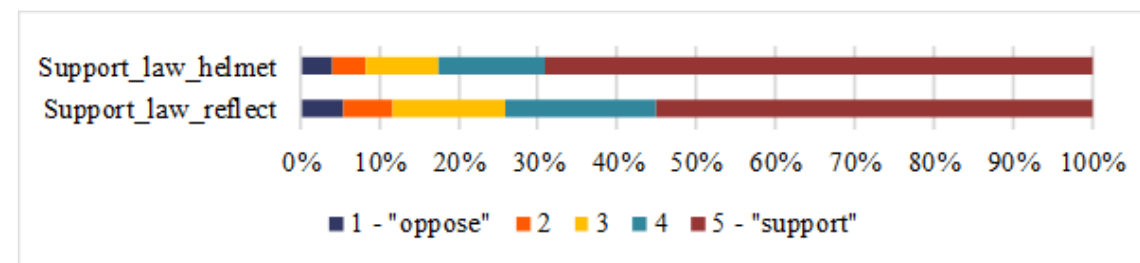
Descriptive Statistics (1/3)

- ▶ The **highest disagreement rates** correspond to driving under the influence of alcohol.
- ▶ However, it is noteworthy that the percentage of PTW riders who disagree with the statement "**most of my friends** would drive after having drunk alcohol" is much lower than the rates of the rest of the alcohol-related questions.
- ▶ On the contrary, it appears that **speeding**-related behaviors are those with the **lowest disagreement rates** reported by PTW riders.
- ▶ It is also evident that **driving after drinking alcohol** is reported as the most frequent cause of a road crash.

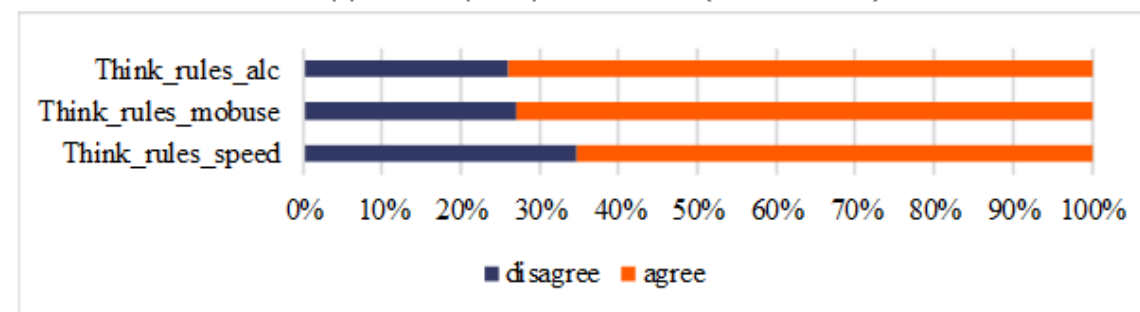


Descriptive Statistics (2/3)

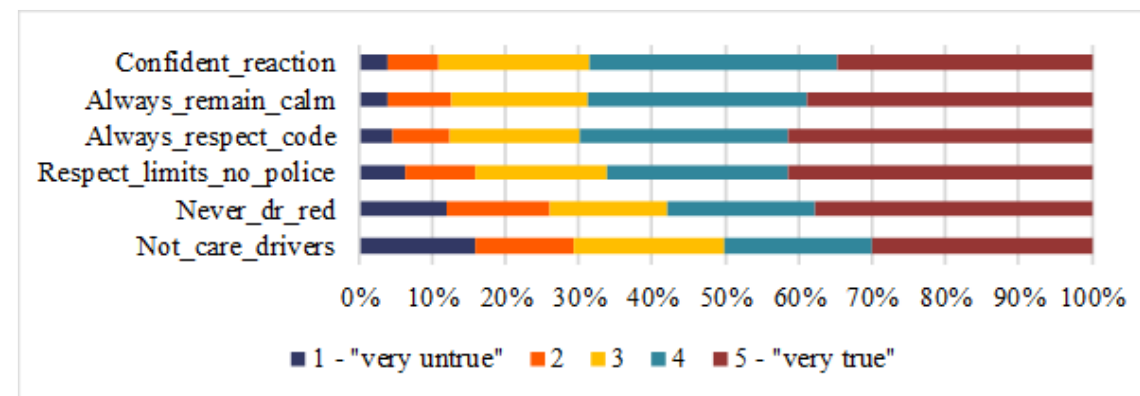
- ▶ The obligatory use of helmets and the use of reflective material when driving in the dark receive **high rates of support** from PTW riders, with slightly higher percentages corresponding to helmet use.
- ▶ About seven out of ten PTW riders believe that **traffic rules should be stricter** (ranging from 65% for speeding to 74% for alcohol).
- ▶ The majority of PTW riders state that they **always respect the highway code**, even if the risk of getting caught is very low.



Support for policy measures (% of riders)



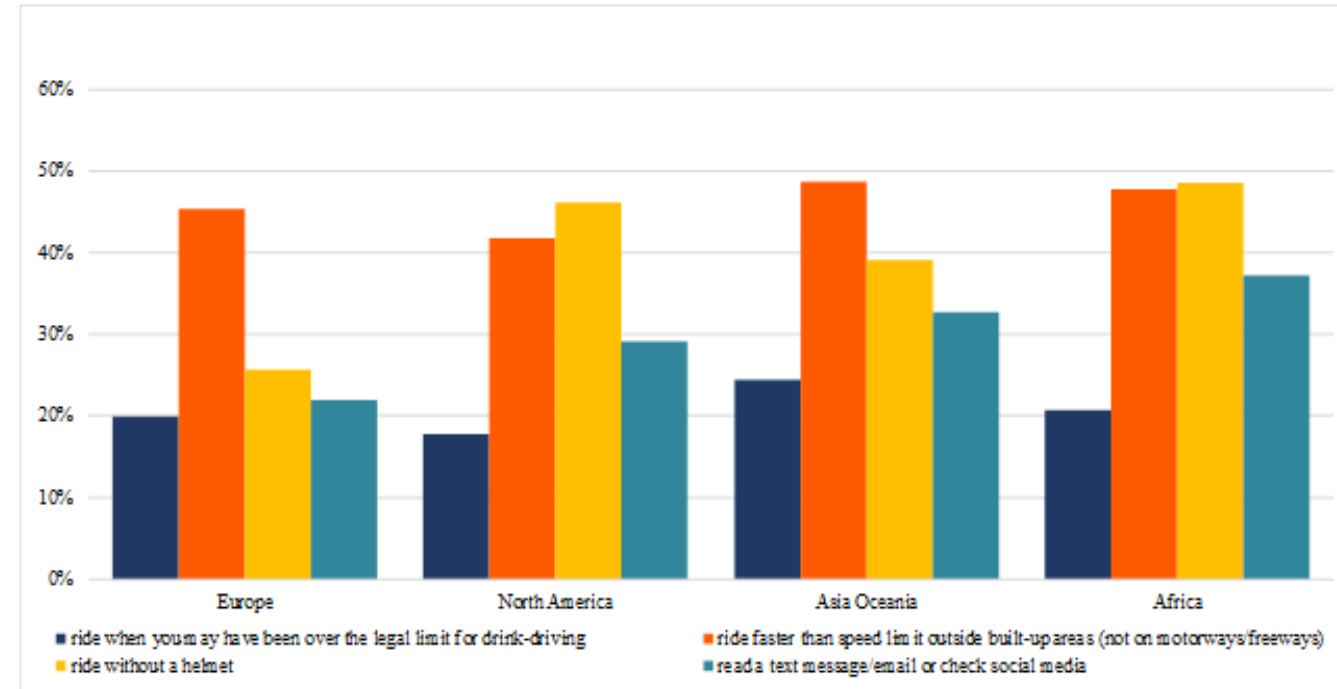
Agreement with stricter traffic rules (% of riders)



Social desirability (% of riders)

Descriptive Statistics (3/3)

- ▶ The **most frequent unsafe behaviors** reported by PTW riders are riding faster than the speed limits outside built-up areas (but not on motorways/freeways) and riding without a helmet.
- ▶ Self-declared **riding without helmet** is significantly higher in Africa (49%), North America (46%) and Asia-Oceania (39%) than in Europe (26%).
- ▶ Self-declared drink riding and speeding rates **do not differ** much between regions.
- ▶ The results of PTW riders for the self-declared behavior of **reading a text message/email or checking social media** while riding vary from 22% in Europe to 37% in Africa.



Self-declared behavior as a PTW rider (% of riders engaging at least once in the past 30 days)

SEM overview (1/2)

- ▶ The **structural equation model**:

- ▶ $\eta = B \eta + \Gamma \xi + \zeta$ Eq. (1)

- ▶ The measurement model for y :

- ▶ $y = \Lambda_y \eta + \varepsilon$ Eq. (2)

- ▶ The measurement model for x :

- ▶ $x = \Lambda_x \xi + \delta$ Eq. (3)

- ▶ y is a vector expressing the dependent (response) variables
- ▶ x is a vector expressing the independent (predictor) variables
- ▶ η is a vector expressing the latent dependent (unobserved) variables
- ▶ ξ is a vector expressing the latent independent (exogenous) variables
- ▶ ε is a vector expressing the regression error term in y
- ▶ δ is a vector expressing the regression error term in x
- ▶ ζ is a vector expressing the regression error term in η
- ▶ Λ_y is a vector expressing the regression coefficients for the dependent variables y on η
- ▶ Λ_x is a vector expressing the regression coefficients for the independent variables x on ξ
- ▶ Γ is a matrix expressing the regression coefficients of ξ in the SEM relationship
- ▶ B is a matrix expressing the regression coefficients of η in the SEM relationship



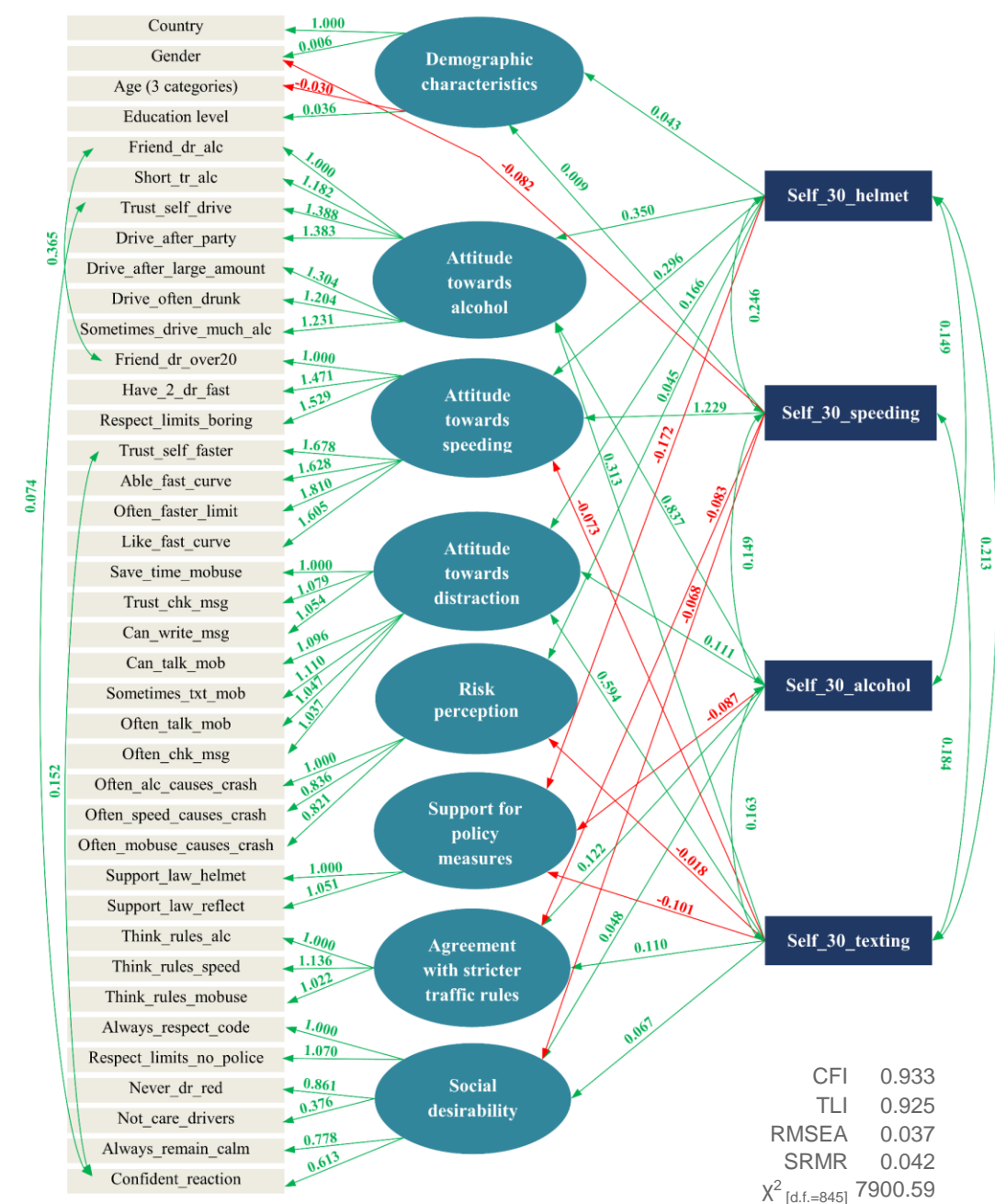
SEM overview (2/2)

- ▶ Structural Equation Modelling belongs to the model family of **latent variable analysis**.
- ▶ It is a multivariate technique which can support **multiple-input and multiple-output** modelling.
- ▶ SEM provides an appropriate vehicle to formulate several **unobserved constructs** in the form of latent variables from the respective question groups and then investigate their correlations with the four risky PTW rider behaviors.
- ▶ **Goodness-of-fit metrics:** χ^2 (chi-squared), the goodness-of-fit index (GFI), the (standardized) root-mean-square residual ((S)RMR), the comparative fit index (CFI) and the Tucker-Lewis Index (TLI).
- ▶ Values **less than 0.07** for SRMR and RMSEA and **more than 0.90** for CFI and TLI are generally accepted as indications of very good overall model fit.



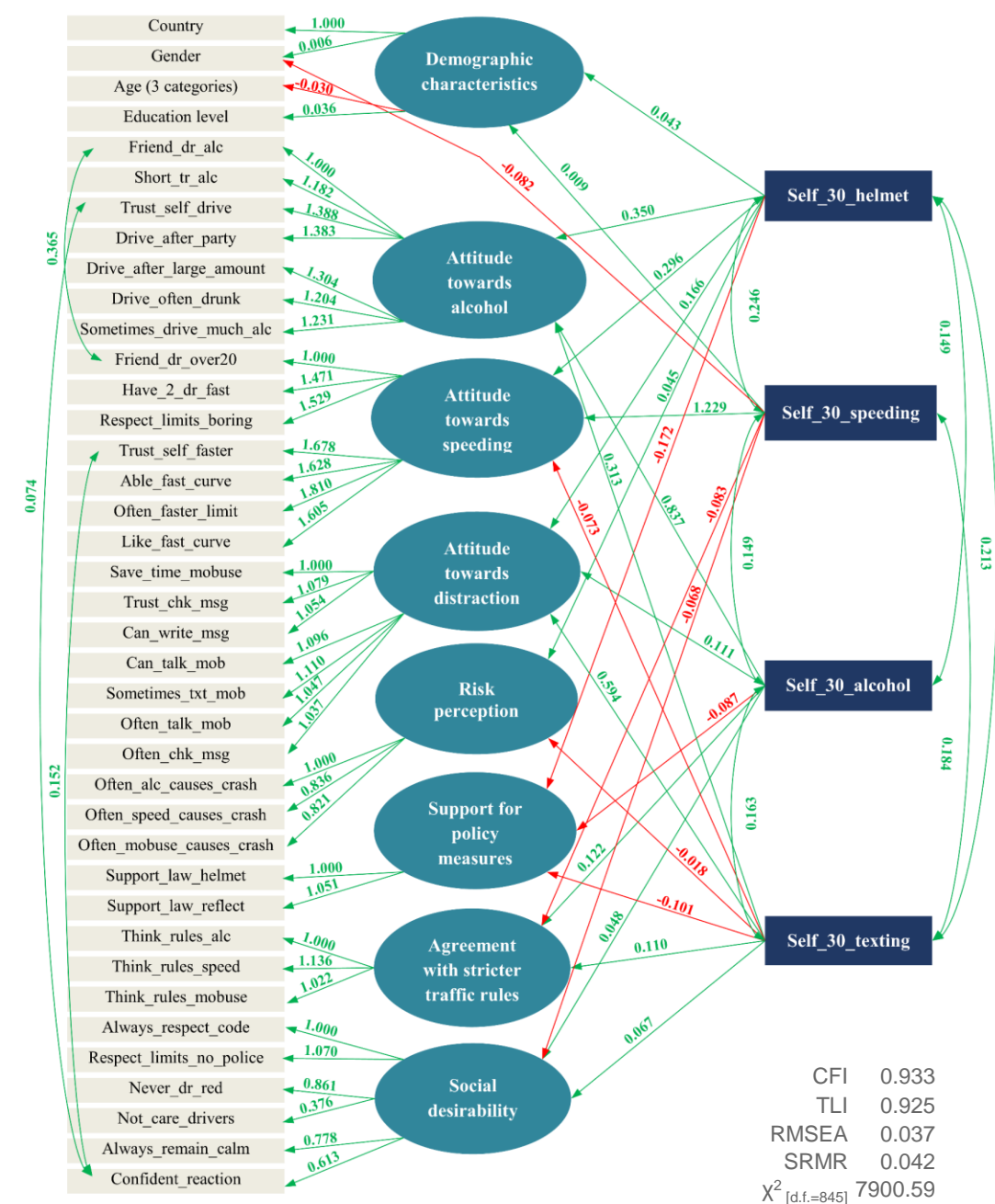
SEM results (1/4)

- **Eight latent variables** were formulated by grouping replies from relevant questions:
 - demographic characteristics
 - attitude towards alcohol
 - attitude towards speeding
 - attitude towards distraction
 - risk perception
 - support for policy measures
 - agreement with stricter traffic rules
 - social desirability
- Green arrows denote positive correlations, while red arrows denote negative correlations – all correlations shown on the path diagram are **statistically significant** ($p\text{-values} \leq 0.05$).
- The analysis was conducted in R-studio (R core team, 2013) using the **lavaan R package** (Rosseel, 2012).



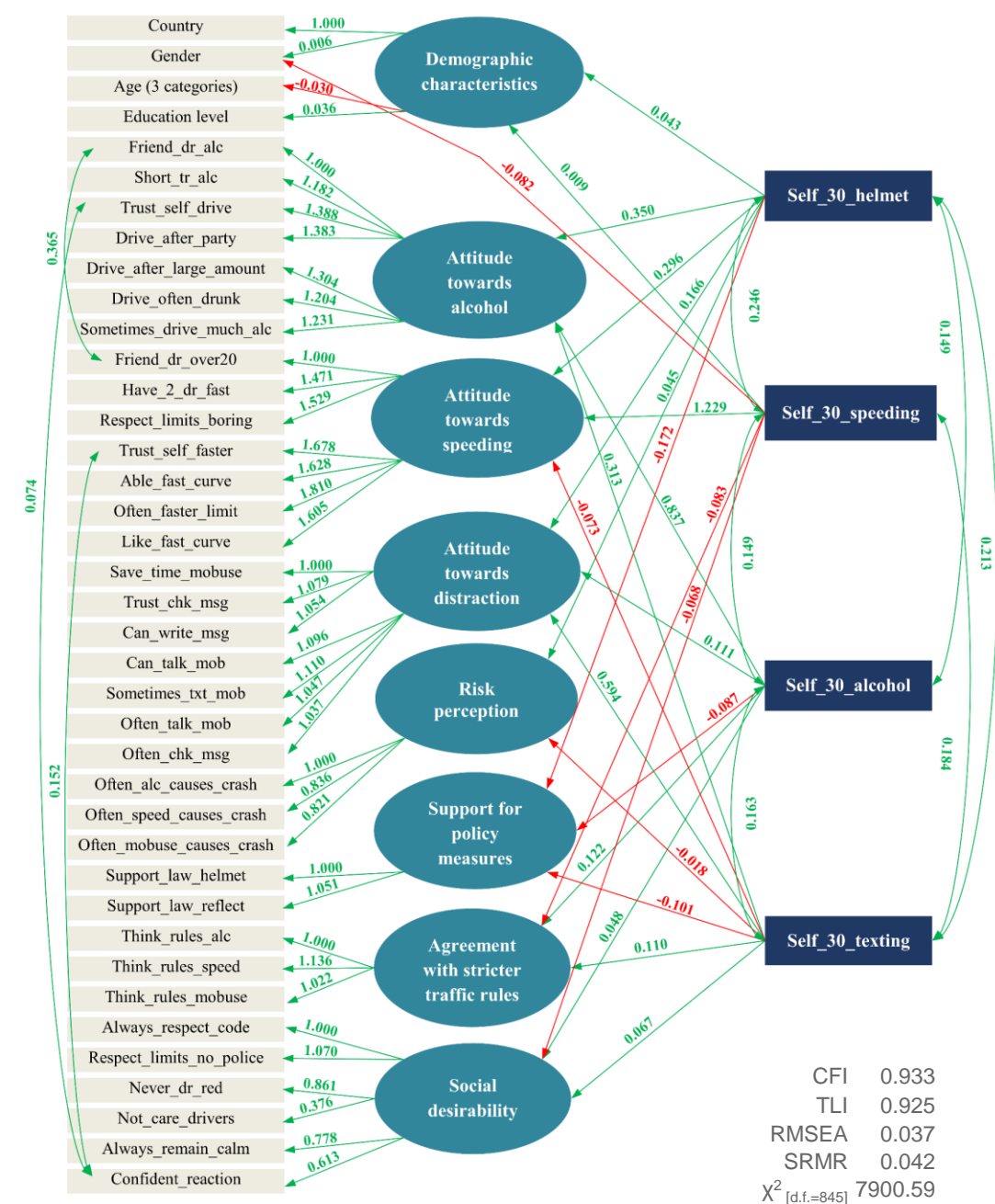
SEM results (2/4)

- **Females** engage in speeding **less frequently** than males.
- Categorical **increases in age lead to lower frequencies** of riding without helmet or speeding.
- More **unsafe attitudes towards alcohol**, are positively correlated with more frequent riding without a helmet, riding while under the influence of alcohol and riding while texting.
- Similarly, more **unsafe attitudes towards speeding**, are reasonably positively correlated with more frequent speeding and with more frequent riding without a helmet.
- The same unsafe attitudes towards speeding are correlated with **fewer instances of texting** while riding.
- This is arguably an indication of the fact that drivers are situationally **aware of threats** caused by handheld mobile phone use and reduce their speed accordingly, or inversely do not manipulate their phones with their hands while speeding.



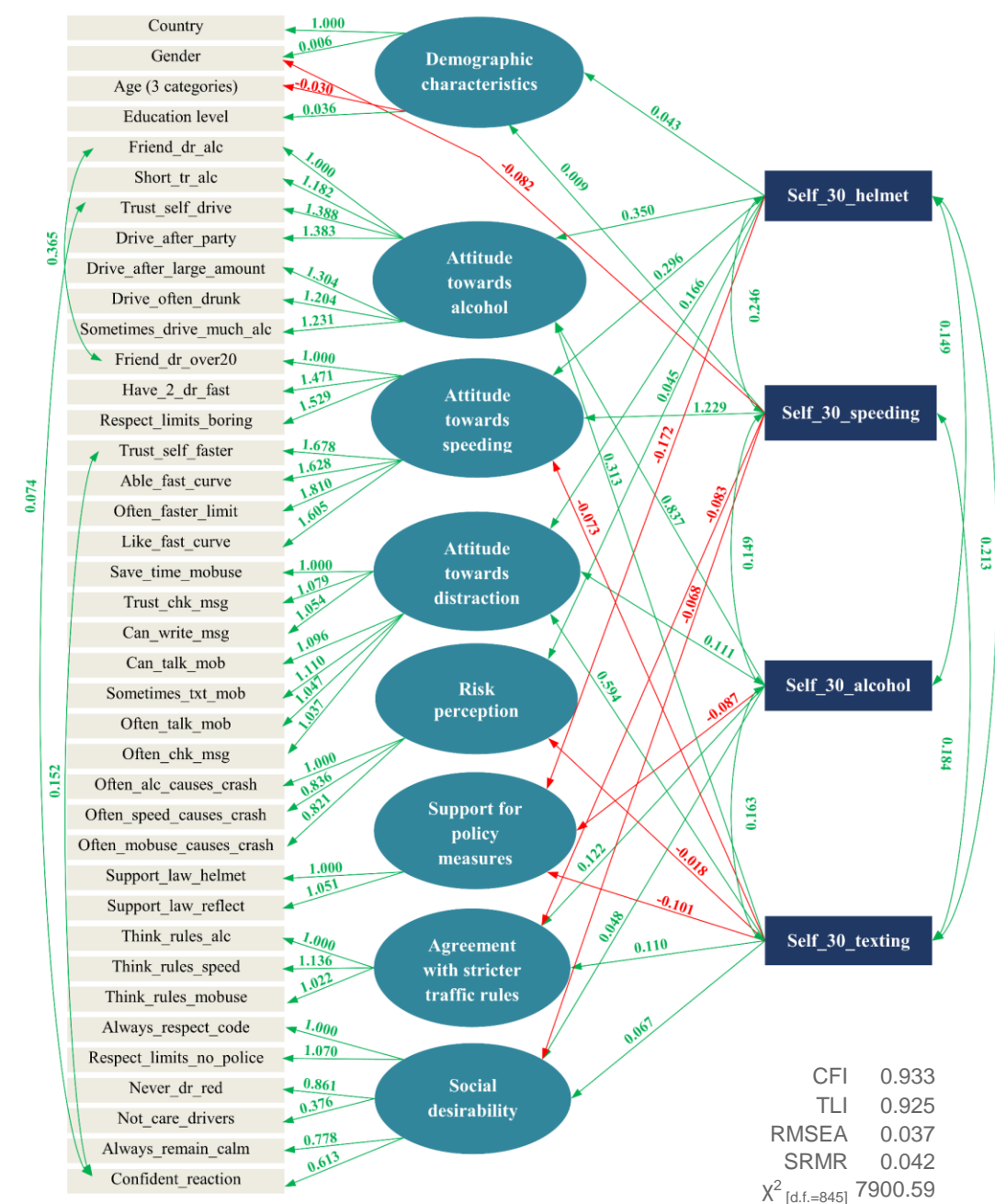
SEM results (3/4)

- More **unsafe attitudes towards distraction** are correlated with more frequent riding without a helmet, riding while under the influence of alcohol and riding while texting as well.
- Higher **risk perception** was found to be correlated with fewer instances of texting while riding a PTW, but also with more frequent instances of riding without a helmet.
- This result indicates that riders recognize **texting as a higher risk than riding without helmet**. Riders are considering that handheld mobile use while texting will hinder their riding performance and perception and will lead to more unsafe events rather than riding without safety equipment.
- Support for policy measures** reflects safer riding attitudes of PTW riders overall.
- Belief in **stricter traffic rules** was found to be correlated with fewer instances of rider speeding, but more frequent instances of riding while under the influence of alcohol.



SEM results (4/4)

- ▶ The awareness to appear **socially desirable** appears to be correlated with fewer instances of riding without a helmet but more instances of riding while under the influence of alcohol and texting while riding.
- ▶ There is a possibility that for riders, social desirability is connected with **peer pressure**, thus they engage in riding under the influence from a desire of acceptance.
- ▶ A similar desire can be the explanation of texting while riding, which could also denote that the rider is **pursuing more social activities**.
- ▶ The dependent variable covariances are all positive and statistically significant indicating that a rider who will engage more frequently in every single one of the four examined unsafe riding behaviors **is more likely to also engage** in all the others as well.



Concluding remarks

- ▶ Numerous statistical relationships were **discovered and quantified** correlating the four examined unsafe rider behaviors with eight latent variables.
- ▶ Unsafe PTW rider behaviors were found to be **positively correlated** with each other, meaning that a driver who engages in one unsafe behavior is more likely to engage in the other behaviors as well.
- ▶ Limitations:
 - ▶ Self reported data have known deficiencies in terms of accuracy and **lack of direct observation** capabilities and **response bias**
 - ▶ Countries were **grouped together**; any variations of the included variables across the studied countries remained uncaptured by the aggregate-level SEM
- ▶ Overall, this study provides an overarching snapshot of and as such is useful to plan and support road safety policies with considerable impacts and benefits, especially for **global or high-level road safety initiatives**.



Key recommendations

- ▶ The high percentages of self-declared risky behaviours by PTW riders impose **targeted measures** to improve their behaviour on the road.
- ▶ **Awareness raising campaigns** should be organised to explain the increased risk and vulnerability of PTW with the ultimate aim to develop a traffic safety culture promoting safety and mutual respect of all road users.
- ▶ PTW safety **enforcement** should be well-structured, systematic and visible.
- ▶ **Road infrastructure** should be adapted to particular PTW characteristics and needs (e.g. installation of PTW friendly barriers), creating a self-explaining and forgiving road environment.



International ESRA Conference

- Traffic Safety Culture and Performance Indicators

April 21, 2022, ONLINE

Correlations of multiple rider behaviors with self-reported attitudes, perspectives on traffic rule strictness and social desirability



Yannis G., Nikolaou D., Ziakopoulos A.
National Technical University of Athens

