



# Patterns of road safety developments in European countries

Emmanuelle Dupont, Heike Martensen  
*Belgian Road Safety Institute*

**DaCoTA Final Conference**  
**Athens, 22-23 November 2012**

## This presentation:

- Past developments: Overview of models
- Forecasts: Main results
- «The forecast factsheets»

# Past developments: Overview of models selected

## (1) Decide on type of model:

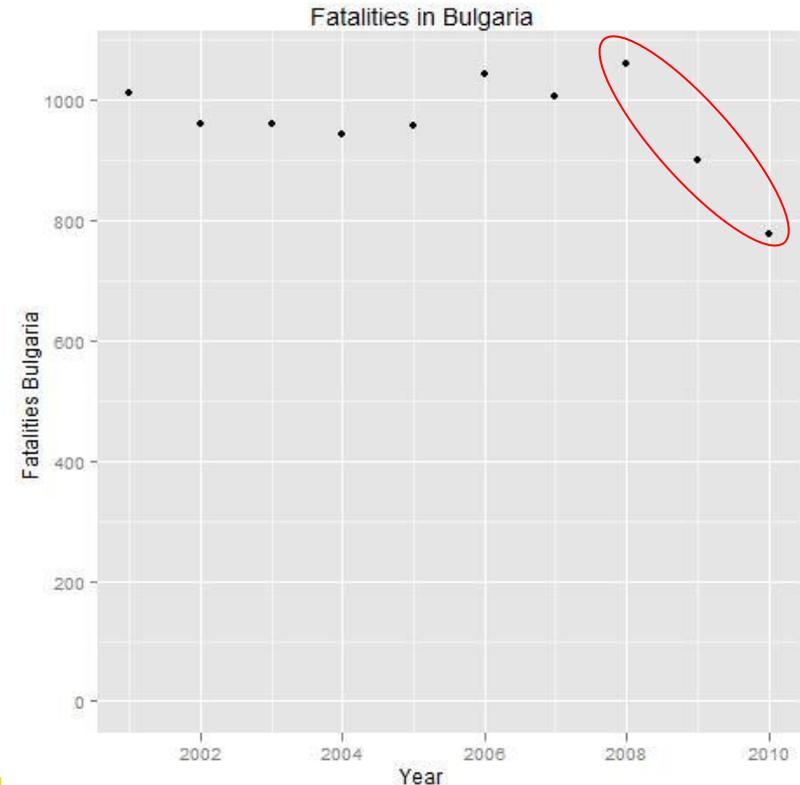
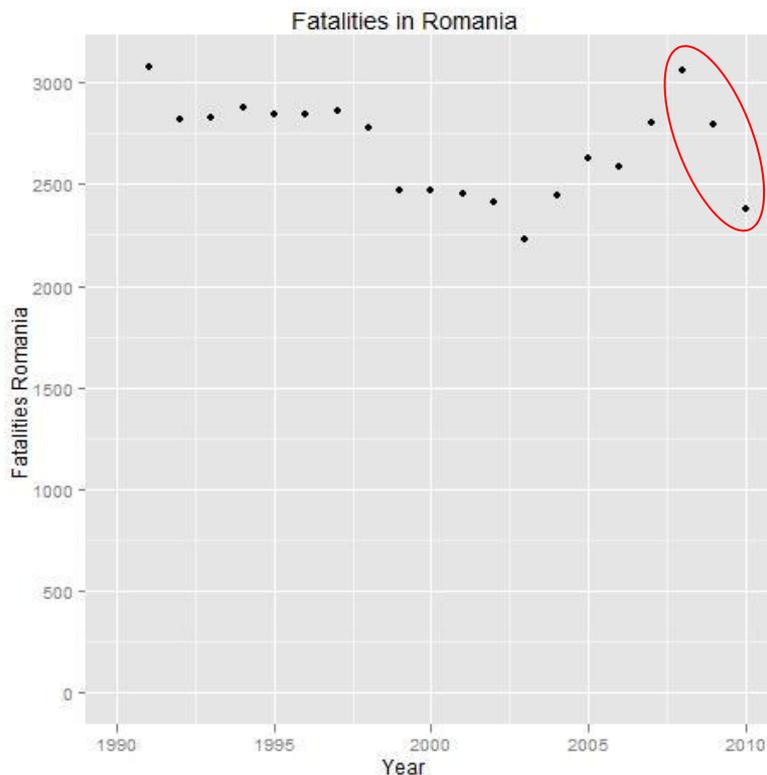
- Latent risk: Fatalities = Exposure \* Risk  
⇒ Two trends
- Univariate:  
⇒ One trend

## (2) Modelling the trend(s)

- The « general process » that will be forecasted  
*Level: « lifts » and « drops »*  
*Slope: change direction/rate*
- Changes that are *no part* of this process and won't be forecasted  
Particular events affecting measurement, level, or slope:  
*Interventions.*

# Modelling past trends: dealing with recent changes

- 2008: stronger decrease in fatality numbers  
 ⇒ Change in « direction », i.e.: slope change



# Modelling past trends: dealing with recent changes

- 2008: stronger decrease in fatality numbers  
⇒ Change in « direction », i.e.: slope change
- Can we assume that this goes on in the future?
  - Yes!  
Acknowledge slope change and make the slope *random*...
  - No! Either:  
Place an intervention (i.e.: define change as structural)  
Fix the slope

« *Precaution principle* »: *Avoid overly optimistic forecasts!*

# Latent risk models (16 countries)

<b>Exposure trend:</b> level fixed, slope random <b>Risk trend:</b> Level random, <i>slope fixed</i>	<b>Exposure trend:</b> level fixed, slope random <b>Risk trend:</b> level and <i>slope fixed</i>	<b>Exposure trend:</b> level fixed, slope random <b>Risk trend:</b> level fixed, slope random	<b>Other models:</b>
Denmark France The Netherlands Spain Switzerland Norway Portugal Estonia Belgium Germany  ⇒ <b>10/16 countries</b>	Cyprus	UK Italy	Austria (no component fixed) Finland (only slope risk fixed) Slovenia (only level exposure fixed)

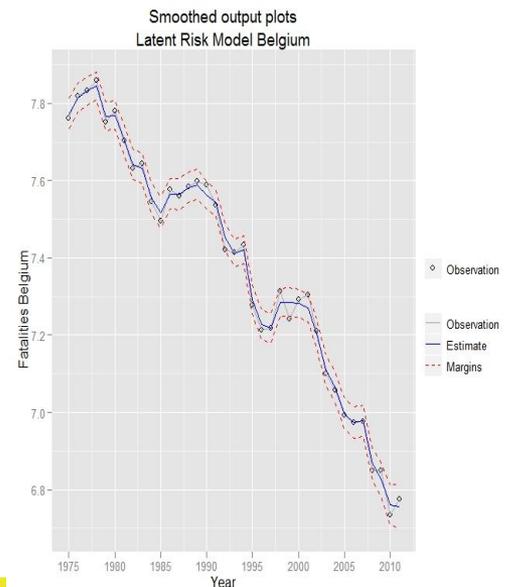
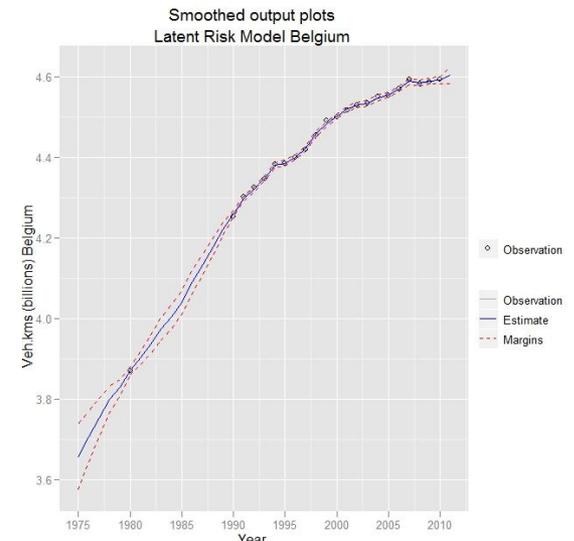
## Univariate models (14 countries)

<b>Fatality trend:</b> level random, <i>fixed slope</i>	<b>Fatality trend:</b> fixed level, <i>fixed slope</i>	<b>Fatality trend:</b> fixed level, random slope
Bulgaria Greece Luxembourg Lithuania Ireland Poland Sweden Latvia Slovakia  ⇒ <b>9/14 countries</b>	Hungary Iceland Malta  ⇒ <b>3/14 countries</b>	Czech Republic Romania  ⇒ <b>2/14 countries</b>

# Models for past developments: Conclusion

⇒ *Exposure: “Smooth trend”*  
*changes in the trends are mainly  
long term changes in direction*

⇒ *Risk and fatality trends:*  
*“Local level model with drift”*  
*changes are rather abrupt*  
*“drops” and “lifts”*



## Forecasts 2020: Main results

# Important considerations

- Continuation of past developments...
- ... and of road safety efforts!
- Erratic developments in the past:  
large confidence intervals!

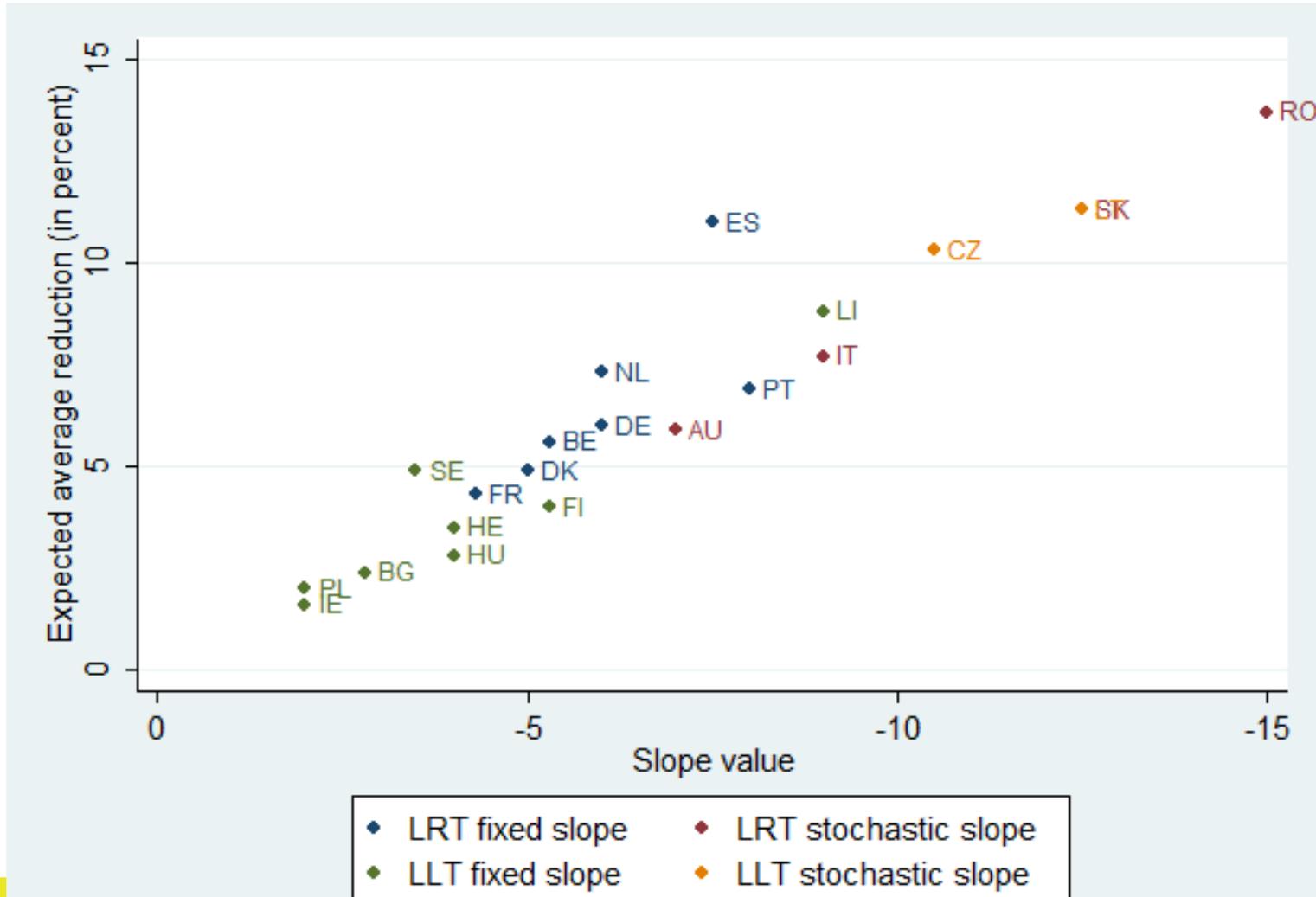
## Forecast results – key elements:

- Slope value:
  - Fixed: constant, the same value for the whole series
  - Stochastic: changing value, *last year of observation used*
- Last observation: Usually 2010
- Average reduction:
  - Difference between last number of fatalities and forecasted one, averaged over the number of years:

$$1 - \text{Exp}\left(\frac{\text{Ln}(2020) - \text{Ln}(\text{LastObs})}{\text{nyears}}\right)$$

- Countries with less than 200 fatalities not included

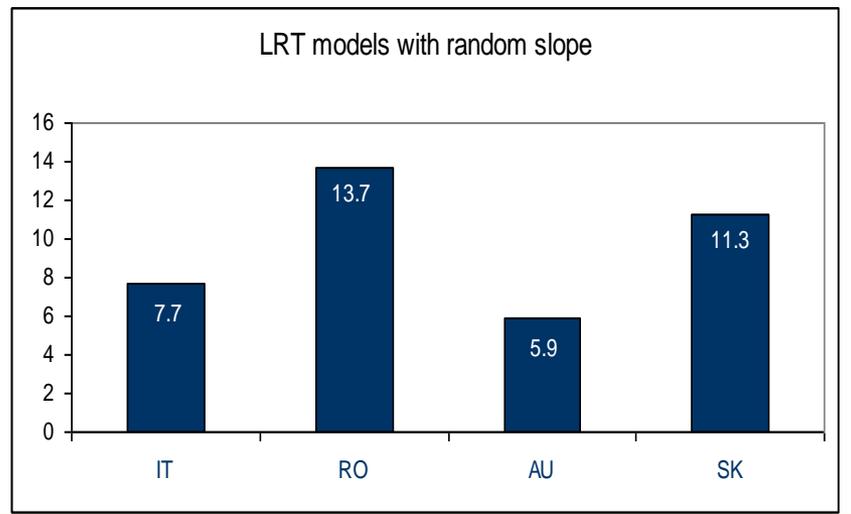
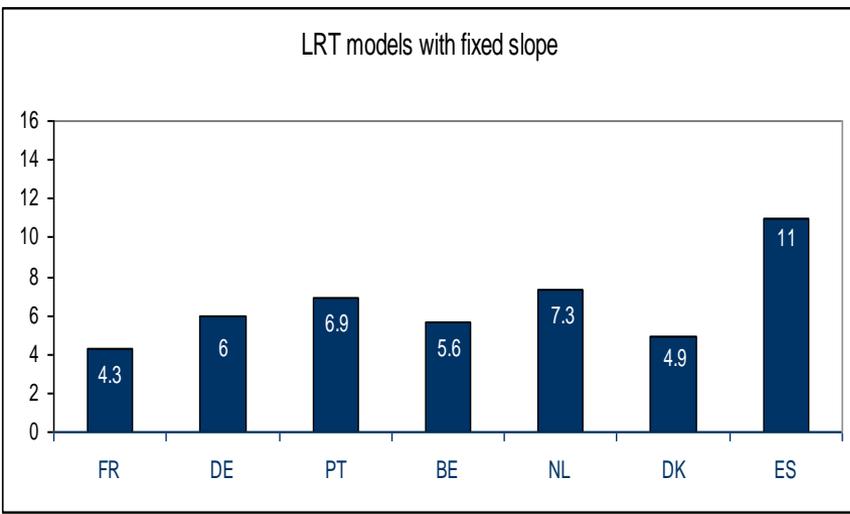
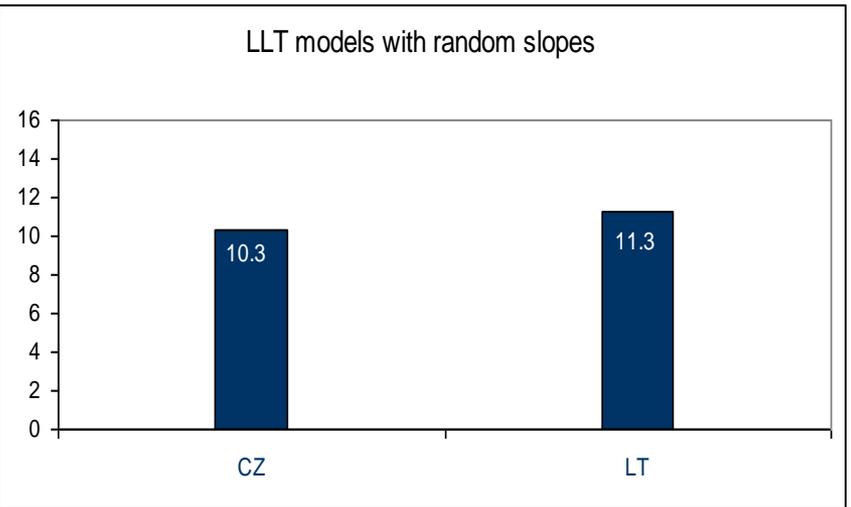
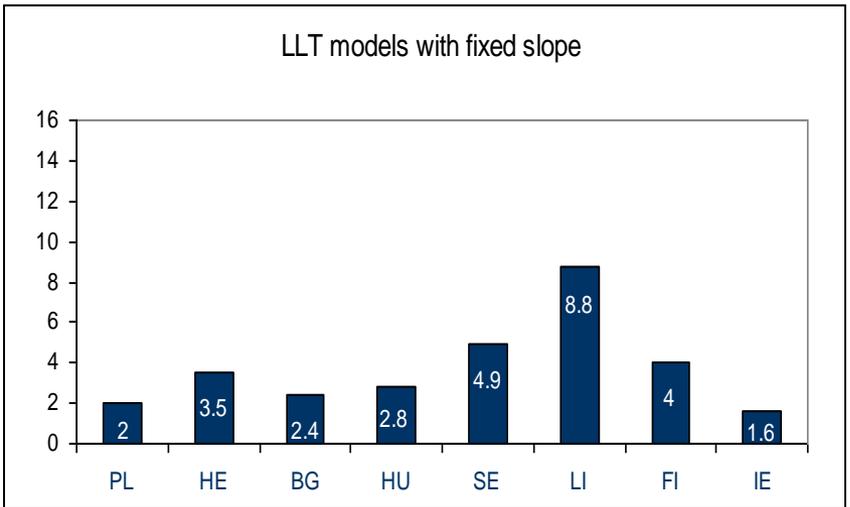
# Models with stochastic slopes are more optimistic...



## Forecasts – Comparing countries

- Necessary to take type of model into account!
  - ⇒ LRT: *risk* slope, univariate: *fatality* slope
  - ⇒ Stochastic and random slopes: difference in forecasts!
- Compare countries *within* but not accross model types...

# Expected average reduction (percent) for...



## « The forecast factsheets »

# Contents

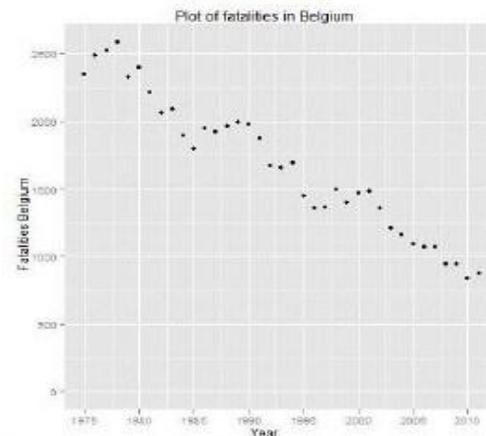
- Description of raw series:

In 2011 the fatality number increased for the first time in a decade

## Road Safety Development

### Belgium

#### Fatalities



- The fatalities have shown a decrease which got stronger over the years
- In 2011 numbers had increased for the first time in a decade.

#### Registration of fatalities

- In 1991, 2001, and 2002 there were changes in the registration of fatalities.
  - o In 1991, the registration form was changed, while the procedure remained the same.
  - o In 2001 a number of changes were implemented.
    - A computerized version of the registration form is used since then (probably making a difference in terms of "lost forms").
    - The whole Belgian police system was reformed at that time, and this may temporarily have given accident registration a lower priority.
    - The statistical office paid more attention to the issue of missing accident forms for fatal victims (as registered by the hospitals), resulting in a strong decrease in the number of non-registered fatal victims.
  - o From 2002 on, the fatal victims for whom there was no accident form were included in the fatality counts.



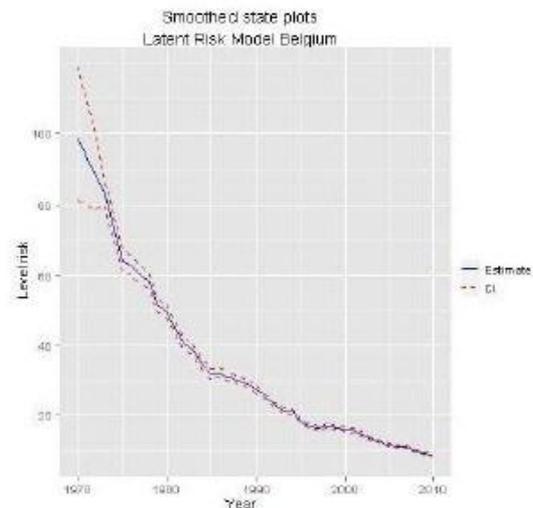
# Contents

- Description of raw series:
- Description of model for past trends:

## Road Safety Development - Belgium

### Fatality Risk

- The fatality risk is the number of fatalities per billion ( $10^9$ ) vehicle kilometres.
- Estimation model: Latent Risk fixed level exposure fixed slope risk [1,2]
- CI: 68% confidence interval ( $\pm 1$  standard deviation)



- The risk for fatalities in Belgium has reduced from almost 80 per billion vehicle kilometres in the mid 70s to less than 10 per billion vehicle kilometres in the most recent years.
- This amounts to a mean decrease of 5.3% per year.

The fatality risk has been decreasing by 5.3% yearly

# Contents

- Description of raw series:
- Description of model for past trends:
- Forecasts given past developments

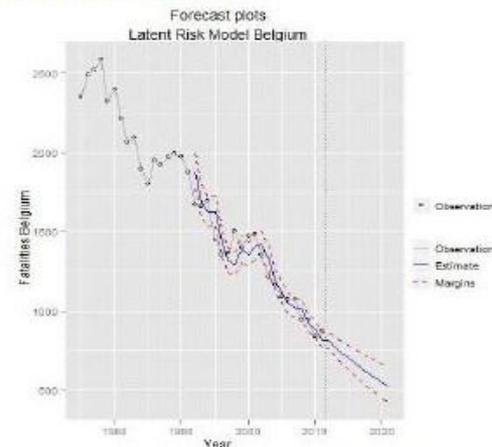
If RS efforts continue at the same level, the expected number of fatalities in 2020 is 548.



## Road Safety Development - Belgium

### Forecasts to 2020

- If road safety is improved at the same rate as previously and the past development of mobility continues, the following forecasts can be made for the number of fatalities in 2020:



Forecast of road-traffic fatalities in Belgium up to 2020

Year	Prediction	Lower CI	Upper CI
2012	813	766	863
2013	774	716	837
2014	737	670	810
2015	701	627	784
2016	667	587	758
2017	635	550	734
2018	605	514	711
2019	575	481	689
2020	548	449	668

#### Disclaimer

- Statistical forecasting does not offer a definite prediction of what is actually going to happen in the future.
- The estimates are based on the "business as usual" assumption: no principal changes between past and future development.
- Even in these conditions future outcomes are uncertain. This uncertainty is represented in the confidence intervals (plotted in the red margins: 66%; printed in table: 95%).

# Contents

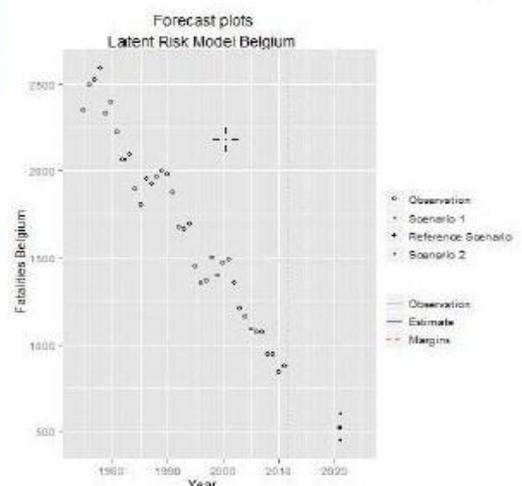
- Description of raw series:
- Description of past trends
- Forecasts given past developments
- *When Latent Risk model:* forecasts according to mobility scenarios:
  - develops as predicted
  - develops *less* strongly than predicted
  - develops *more* strongly than predicted

## Road Safety Development - Belgium

### Scenarios

- The strong uncertainty about the development of the fatalities in Belgium is for a good part due the development in traffic volume.
- To illustrate that, three point-estimates for fatalities in Belgium 2021 are plotted assuming three different scenarios for traffic volume.
  - o Reference: continuation of development (forecasted value)
  - o Scenario 1: strong growth (forecasted value +1 stand. deviation)
  - o Scenario 2: decrease (forecasted value -1 stand. deviation)

Forecast plots  
Latent Risk Model Belgium



Scenarios for Traffic Volume

	Vehicle kilometers (billions)	Road traffic fatalities
<b>Situation 2010:</b>	98.7	840
<b>Prediction 2021 according to mobility scenarios:</b>		
- Continuation of development (increase)	105	521
- Stronger increase than predicted	121	602
- Less increase than predicted	90	451





Project co-financed by the European Commission, Directorate-General for Mobility and Transport 5 / 6

## Warm thanks to:

- Research teams:
  - TRL: Jeremy Broughton, Jackie Knowles
  - DGT: Catherine Perez, Elena Santamariña
  - NTUA: Costas Antoniou, Eleonora Papadimitriou, George Yannis
  - Hasselt University: Elke Hermans
  - IFSTTAR: Sylvain Lassarre
  - SWOV: Frits Bijleveld, Jacques Commandeur
  - CTL: Gabriele Giustiniani, Davide Shingo Usami
- « CARE experts » appointed by the member states and EU