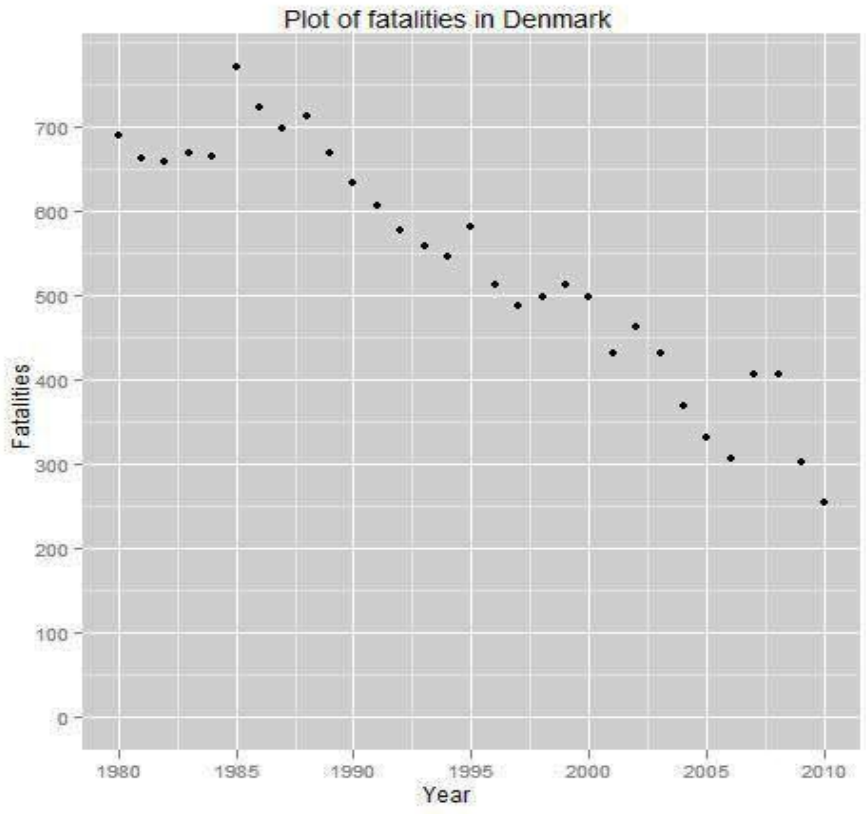
Denmark

Fatalities

Since 1980, the annual number of fatalities has decreased by 3% per year on average.



- 690 fatalities have been registered in Denmark in 1980 against 255 in 2010, which amounts to a total decrease of 60%.
- The estimated average annual decrease in the number of fatalities is 3%.

Registration of fatalities

- A fatality is defined as a death occurring within 30 days following an accident. A 100% registration can be assumed with confidence in the case of Denmark as far as fatalities are concerned.

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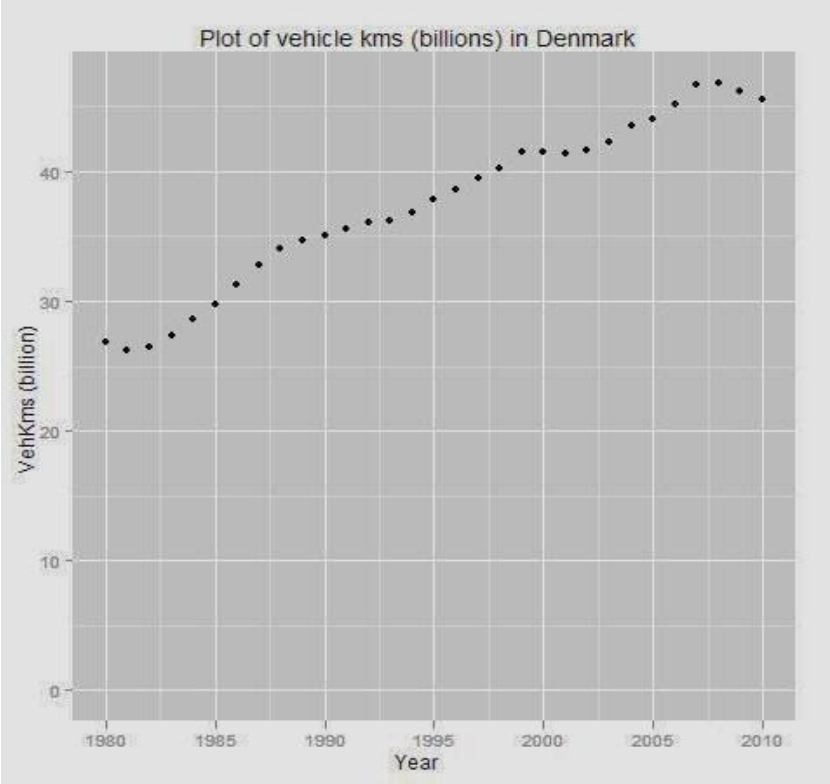
Road Safety Development - Denmark

Mobility has been increasing in Denmark up to 2008. Since then, it is decreasing.

Traffic Volume



- The number of fatalities depends strongly on the amount of traffic (exposure). To forecast the fatalities, the development of exposure has to be forecasted first.
- The selected measure for traffic volume is the annual vehicle kilometres (in billions). This data is available in Denmark from 1980 onwards.
- Development:
  - 1980 and 1981: slight decrease (2%).
  - 1981 to 2008: continuous increase, at varying rates (oscillating between 5 and 0%).
  - Since 2008: decrease (1 – 1,5%).
- There is a significant relation between the development of the traffic volume and of the annual fatality numbers in Denmark: the moments at which the increases in vehicle kilometers became stronger are also those at which the decreases in the risk became weaker.

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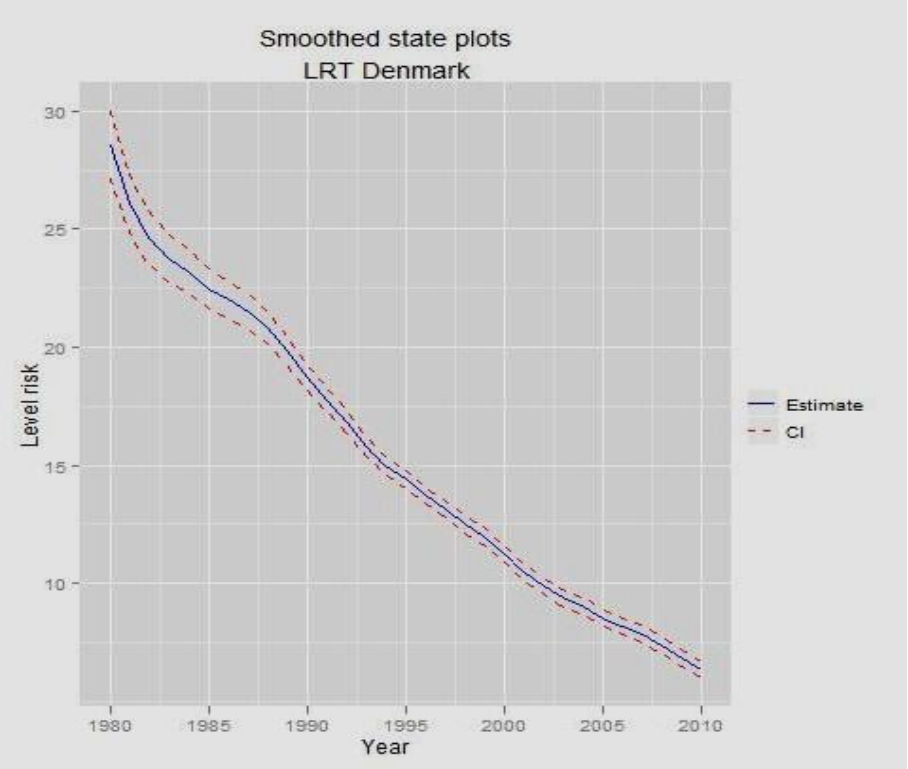
Fatality Risk

- The fatality risk is the number of fatalities per billion (10^9) vehicle kilometres.
- Estimation model – technical definition:
  - Latent Risk Model [1,2]
  - Fixed level exposure, fixed slope risk.
- CI: 68% confidence interval



The fatality risk has been decreasing by 5% yearly

- The risk for fatalities in Denmark has reduced from almost 29 per billion vehicle kilometres in 1980 to around 4 per billion vehicle kilometres in 2010.
- This amounts to a mean decrease of 5% per year.

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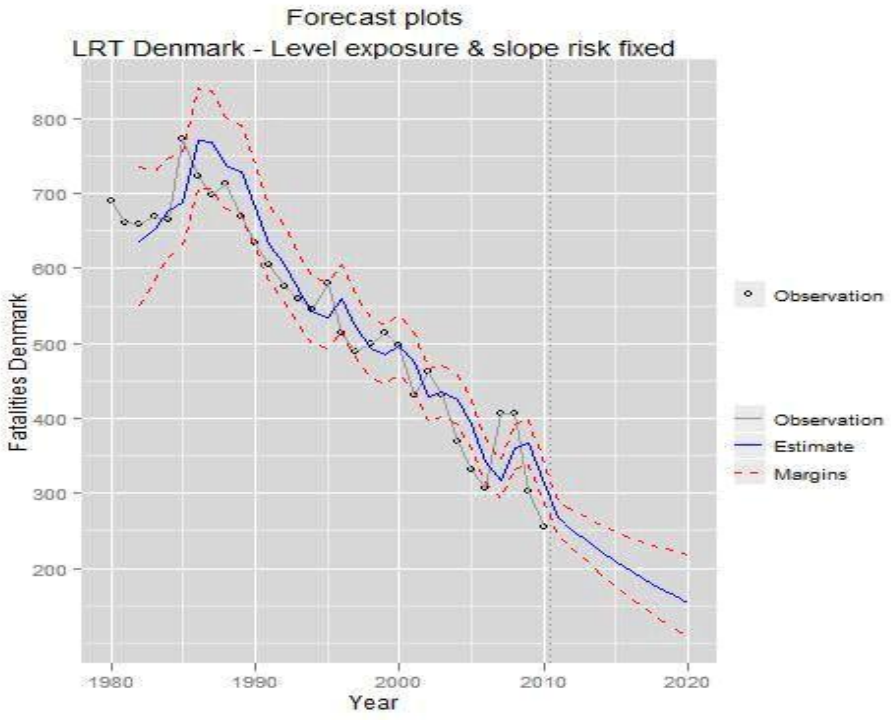
Forecasts to 2020

– If road safety is improved at the same rate as previously and the past development of mobility continues, the following is to be expected for the number of fatalities in 2020:

If RS efforts continue at the same level, around 154fatalities are to be expected in 2020.



Forecast of road-traffic fatalities in Denmark up to 2020

Year	**Prediction**	Lower CI	Upper CI
2011	**266**	226	314
2012	**251**	205	307
2013	**236**	185	302
2014	**222**	166	298
2015	**209**	148	295
2016	**197**	132	295
2017	**185**	116	295
2018	**174**	102	297
2019	**164**	90	301
2020	**154**	78	306

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: 68%; printed in table: 95%).

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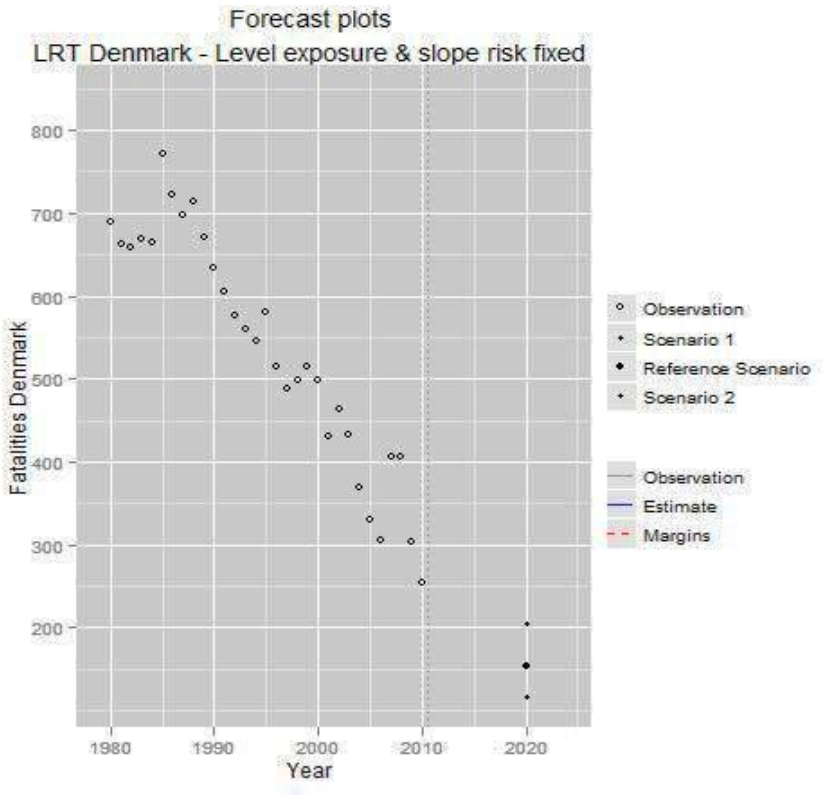
Scenarios

- The uncertainty about the development of the fatalities observed in Denmark is for a good part due the development in traffic volume.
- To illustrate that, three point-estimates for fatalities in Denmark in 2020 are plotted assuming three different scenarios for traffic volume:
  - Reference: continuation of development, i.e.: decrease in number of vehicle kilometres (forecasted value)
  - Scenario 1: stronger growth (forecasted value + 1 stand. deviation)
  - Scenario 2: stagnation (forecasted value - 1 standard deviation)



Scenarios for Traffic Volume

	Vehicle kilometers (billions)	***Road traffic fatalities***
Situation 2010:	45.54	255
Prediction 2020 according to mobility scenarios:		
- Continuation of development (decrease) - Increase - Stronger decrease than predicted	40 54 30	154 206 116

References

[1] EC National Expert for road accident statistics and road safety performance indicators.

|2] Dupont & Martensen (Eds.) 2012. Forecasting road traffic fatalities in European countries. Deliverable 4.4 of the EC FP7 project DaCoTA.

[3] Bijleveld F., Commandeur J., Gould P., Koopman S. J. (2008). Model-based measurement of latent risk in time series with applications. Journal of the Royal Statistical Society, Series A, 2008.

[4] Martensen & Dupont (Eds.) 2010. Forecasting road traffic fatalities in European countries: model and first results. Deliverable 4.2 of the EC FP7 project DaCoTA.

[5] Commandeur, J. & Koopman, S.J. (2007). An Introduction to State Space Time Series Analysis. Oxford University Press.