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Formulating Longitudinal Regression Models in R

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Introduction

Aim: To create a free software package for easy specification of generalized dynamic linear models
Alternatives: Ox + SsfPack, StructTS. But they are not easy to use, or do not support complex models
Idea: Use the glm-call in R as a template and use iterated extended Kalman smoothing

The package sspir is available from CRAN cran.r-project.org

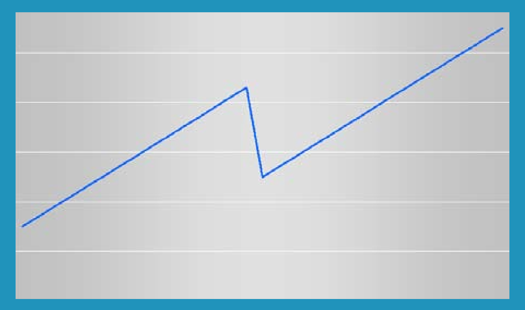
Model

$$y_t \sim \text{Exp.fam.}(\lambda_t = F_t^\top \theta_t)$$
$$\theta_t \sim N(G_t \theta_{t-1}, W_t)$$

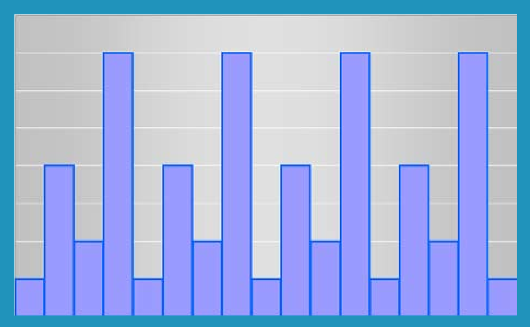
STATIC

Time trend
polytime(time,1)

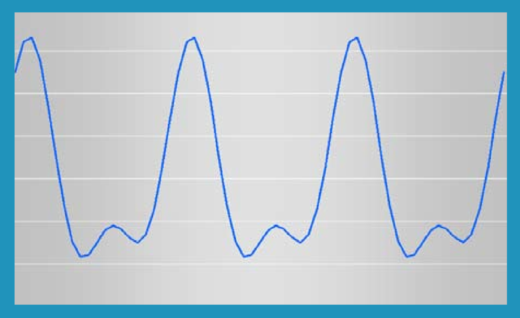
Covariates/interventions



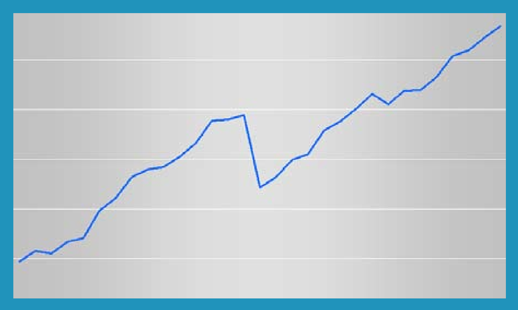
Seasonal variation
Unstructured
sumseason (time,4)

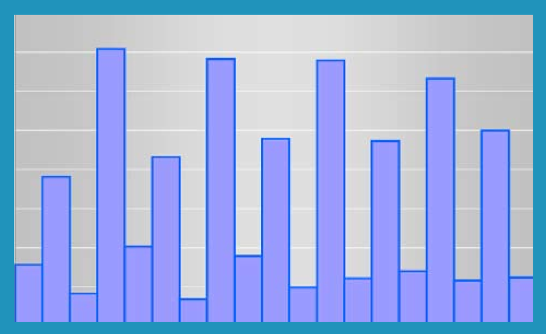


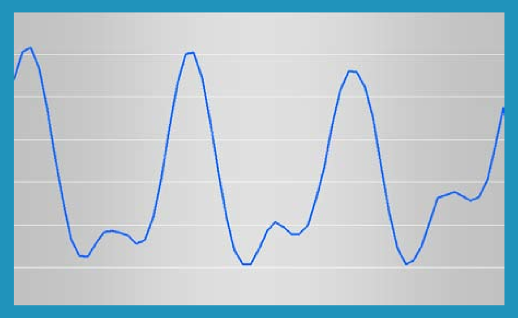
Harmonic
polytrig(time,2)



DYNAMIC

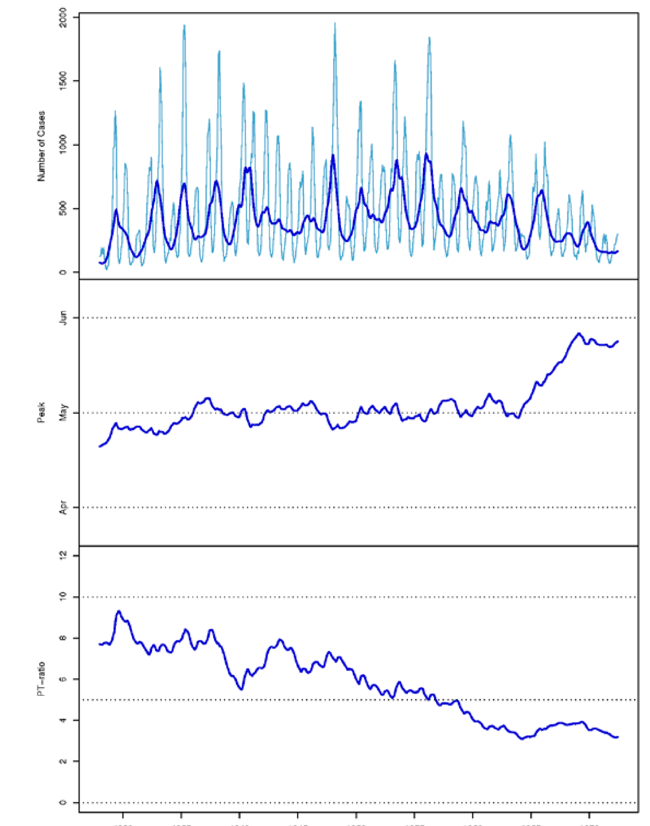






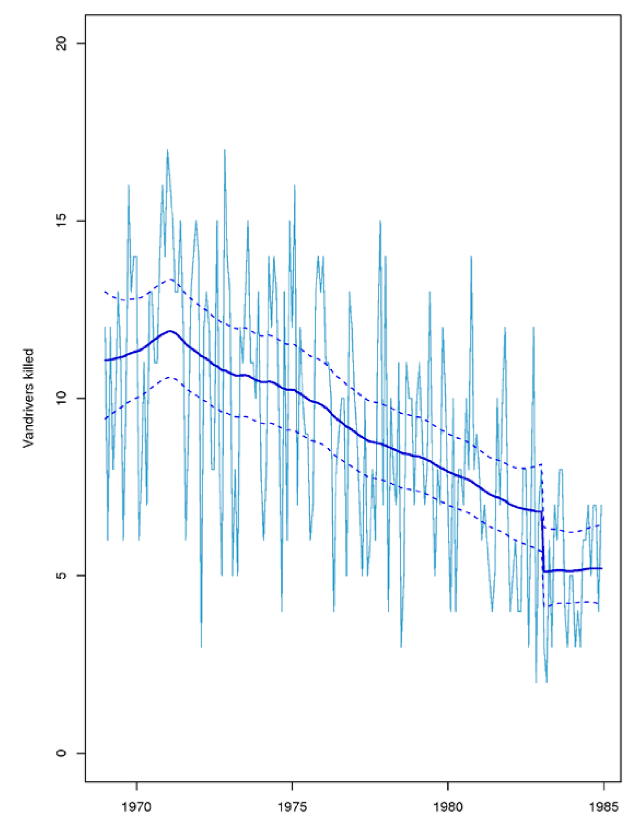
Examples

Variation in the incidence of mumps, NYC, 1927-1972



```
ssm ( mumps ~ -1 + tvar(polytime(index,1)) +
          tvar(polytrig(index,12,1)),
          family=poisson(link=log),
      phi=phi.start,
      C0 = diag(4)
      )
```

Monthly numbers of light goods van drivers killed in road accidents from 1969 to 1984 in UK



```
ssm( y ~ tvar(1) + seatbelt +
sumseason(time,12),
        family=poisson(link="log"),
        data=vandrivers,
        phi = c(1,0.0004945505),
        C0=diag(13)*1000
        )
```

See also the poster
"Assessing seasonality in count data"

Discussion
Estimation of hyper-parameters is not implemented
The approach is very general, but slow
Random walk evolution of dynamic parameters vs. AR(1)
Multi process state space models can be built easily

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