First the insolvency data are loaded:

```r
library(catdata)
data(insolvency)
attach(insolvency)
```

For the number of insolvent firms between 1994 and 1996 a Poisson model is fitted with time as predictor. Time is considered as a number from 1 to 36, denoting the month from January 1994 to December 1996.

```r
ins1 <- glm(insolv ~ case + I(case^2), family=poisson(link=log), data=insolvency)
summary(ins1)
```

```
Call:
glm(formula = insolv ~ case + I(case^2), family = poisson(link = log),
data = insolvency)

Deviance Residuals:
 Min 1Q Median 3Q Max
-3.2037 -0.9083 -0.2517 0.4880 3.0340

Coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) 4.1916952 0.0617994 67.827 < 2e-16 ***
case 0.0197825 0.0073901 2.677 0.00743 **
I(case^2) -0.0002670 0.0001896 -1.409 0.15897

---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for poisson family taken to be 1)

Null deviance: 108.128 on 35 degrees of freedom

1
Scatter-Plot of number of insolvent firms dependent of the month (1-36). With estimated curve of the log-linear model.

```r
plot(case, insolv)
points(ins1$fitted.values, type="l")
```

In many real-world datasets the variance of count-data is higher than predicted by the Poisson distribution. So next a Poisson model with dispersion parameter is fitted (Quasi-Poisson model).

```r
ins2 <- glm(insolv ~ case + I(case^2), family=quasipoisson, data=insolvency)
summary(ins2)
```
## Call:
## glm(formula = insolv ~ case + I(case^2), family = quasipoisson,
##     data = insolvency)
##
## Deviance Residuals:
##    Min 1Q Median 3Q Max
## -3.2037 -0.9083 -0.2517 0.4880 3.0340
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.1916952 0.0939826 44.601  <2e-16 ***
## case       0.0197825 0.0112387  1.760  0.0876 .
## I(case^2)  -0.0002670 0.0002883 -0.926  0.3611
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for quasipoisson family taken to be 2.312738)
##
## Null deviance: 108.128 on 35 degrees of freedom
## Residual deviance: 75.287 on 33 degrees of freedom
## AIC: NA
##
## Number of Fisher Scoring iterations: 4

# plot(ins2)

An alternative to a quasi-poisson model is to use the negative binomial distribution.

```r
library(MASS)
ins3 <- glm.nb(insolv ~ case + I(case^2), data=insolvency)
summary(ins3)
```

## Call:
## glm.nb(formula = insolv ~ case + I(case^2), data = insolvency,
##     init.theta = 77.92952593, link = log)
##
## Deviance Residuals:
##    Min 1Q Median 3Q Max
## -2.3666 -0.6333 -0.1710 0.3350 2.0042
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept) 4.1953863 0.0861256 48.712  <2e-16 ***
## case       0.0192833 0.0105170  1.834  0.0667 .
## I(case^2)  -0.0002546 0.0002728 -0.933  0.3506
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Since counts are rather large in addition a normal distribution model is fitted.

```r
ins4 <- glm(insolv ~ case + I(case^2), family=gaussian(link=log), data=insolvency)
summary(ins4)
```

```
Call:  
glm(formula = insolv ~ case + I(case^2), family = gaussian(link = log), 
data = insolvency)

Deviance Residuals:  
Min 1Q Median 3Q Max  
-25.809 -8.744 -2.374 4.560 30.480  

Coefficients:  
Estimate Std. Error t value Pr(>|t|)  
(Intercept) 4.1836089 0.1005663 41.600 <2e-16 ***  
  case 0.0208026 0.0115423 1.802 0.0806 .  
  I(case^2) -0.0002915 0.0002896 -1.007 0.3214  
---  
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  

(Dispersion parameter for gaussian family taken to be 193.2793)

Null deviance: 9147.0 on 35 degrees of freedom  
Residual deviance: 6378.1 on 33 degrees of freedom  
AIC: 296.54  

Number of Fisher Scoring iterations: 4