Advertising case

`sale`: Total number of sold items.

`normalsale`: A proxy of the normal sale in the same week.

`store`: The id-number of the store.

`ad`: Advertising (0 = no advertising, 1 = advertising).

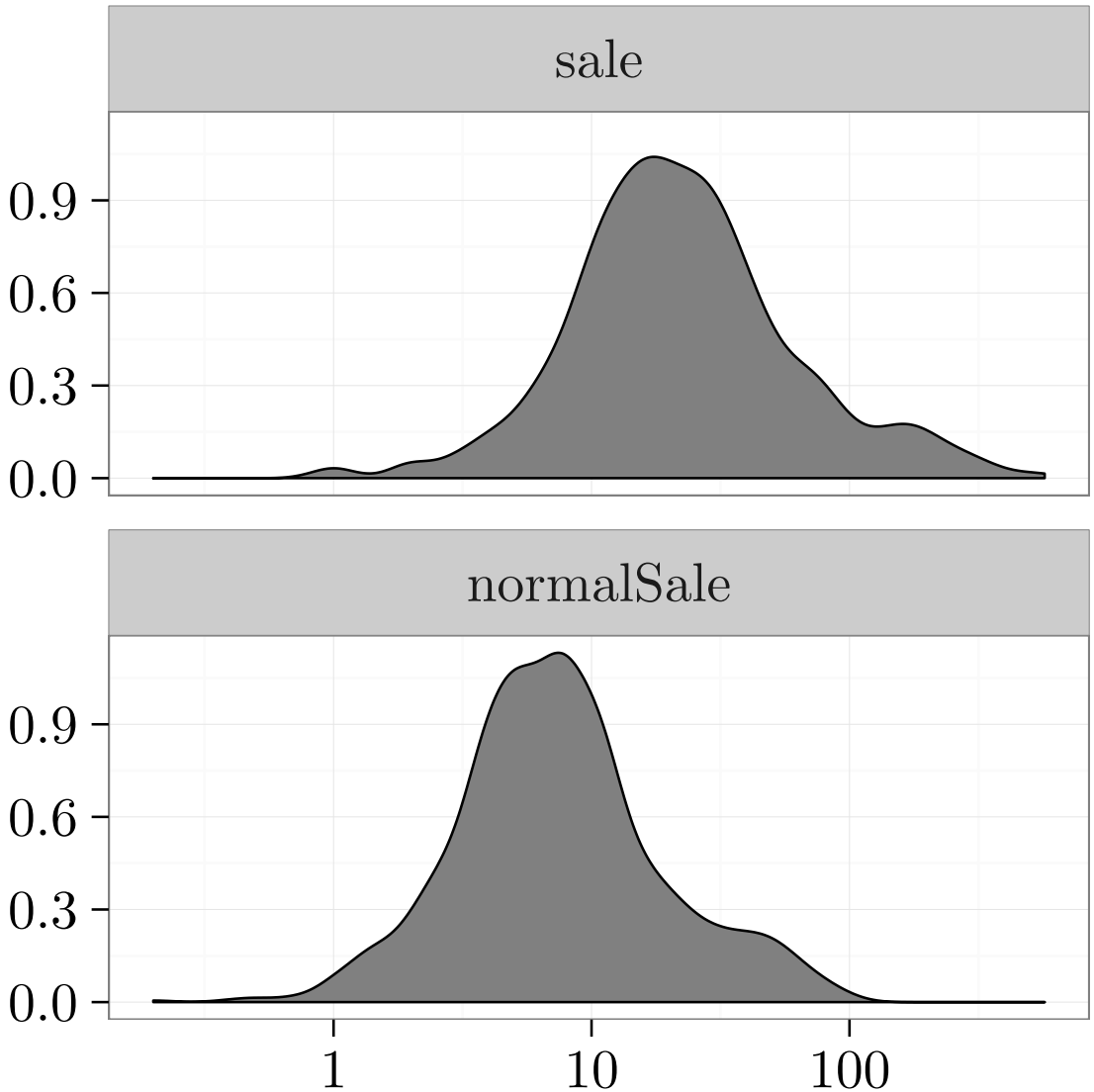
`discount`: Discount in percent.

`discountSEK`: Discount in Swedish kroner.

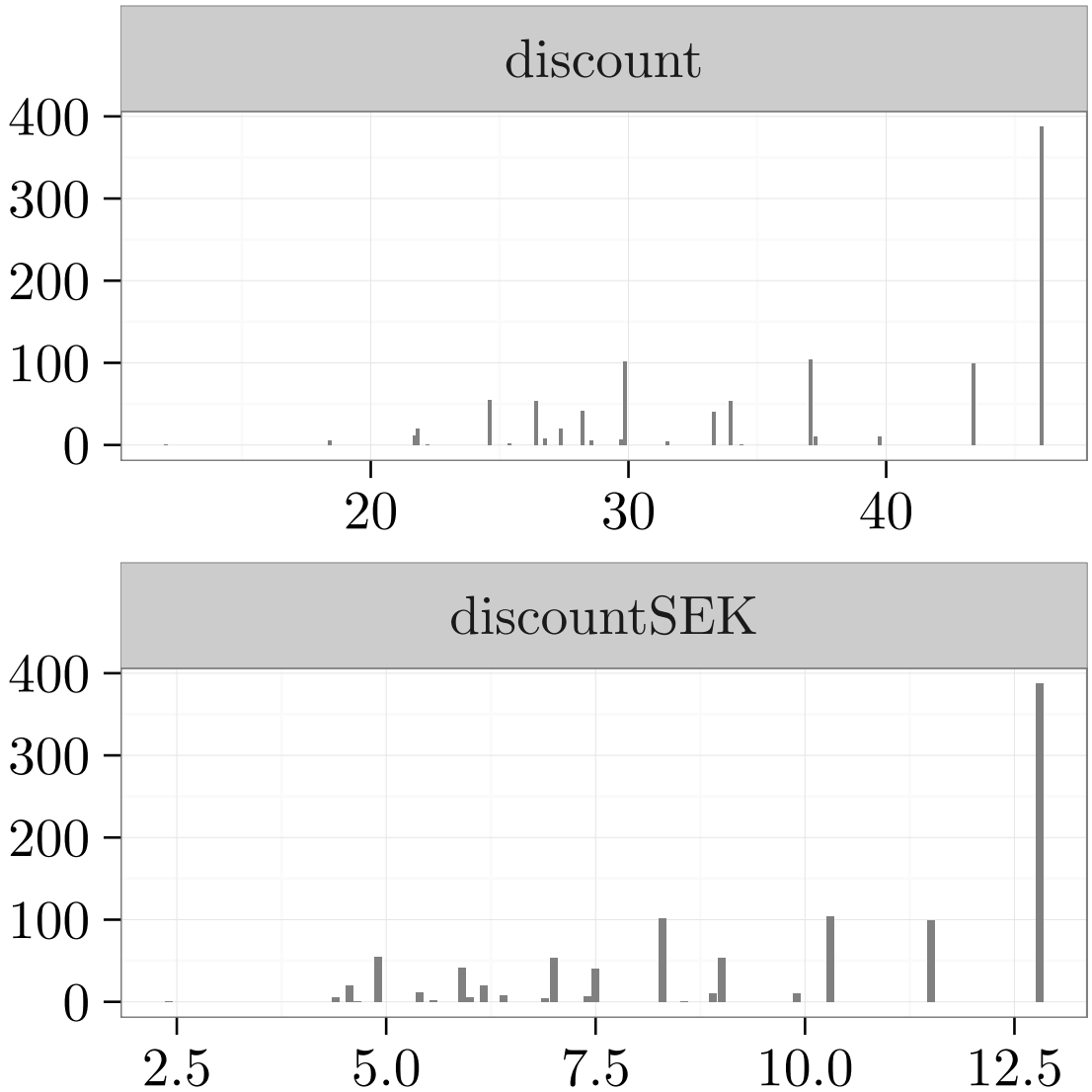
`week`: Week number (2, 4, 5, 7, 8, 9).

Objective: Predict sale for the individual store based on the normal sale and information about the advertising campaign.

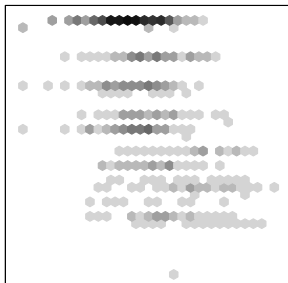
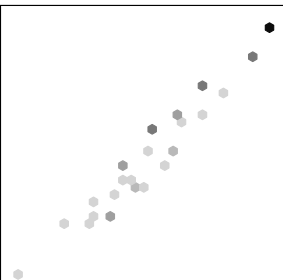
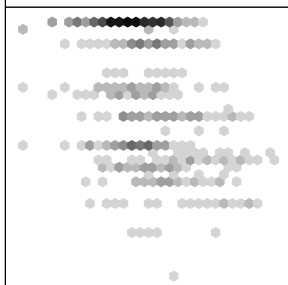
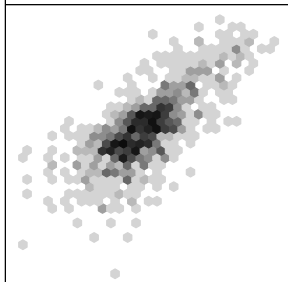
Sale distributions



Discount distributions



Scatter plot matrix

			discountSEK
		discount	0.98
	normalSale	-0.47	-0.54
sale	0.74	-0.4	-0.48

Week and advertising cross tabulation

	0	1
2	25	0
4	1	164
5	0	44
7	344	0
8	317	0
9	0	171

Advertising case

A log-linear model with a Poisson response and

$$E(Y \mid N, X) = Ne^{X^T\beta} = e^{\log(N)+X^T\beta} \tag{1}$$

with N the normal sale and X the other predictors is suggested.

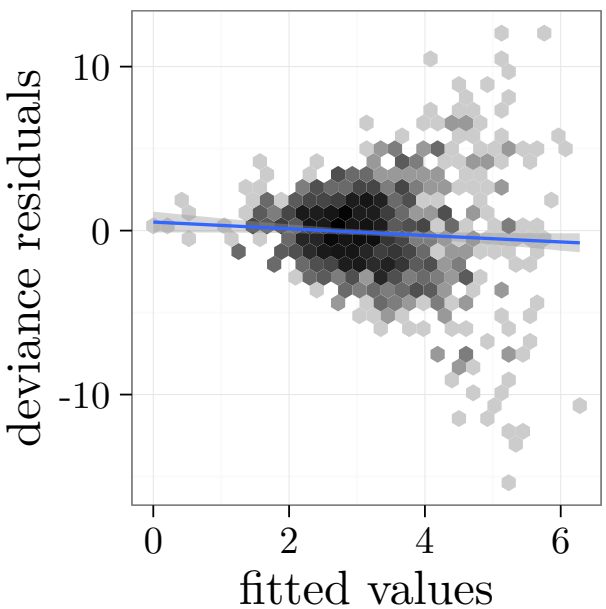
```
form <- sale ~ offset(log(normalSale)) + store + ad +
        discount + discountSEK - 1

vegetablesGlm <- glm(form,
                     family = poisson,
                     data = vegetables)
```

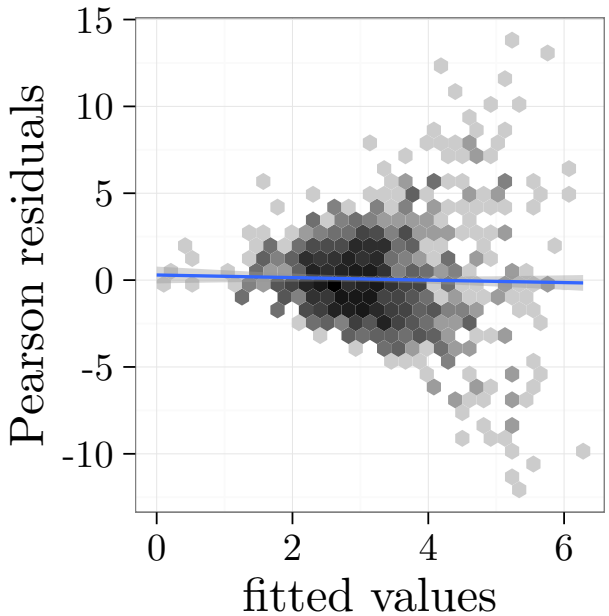
Advertising case

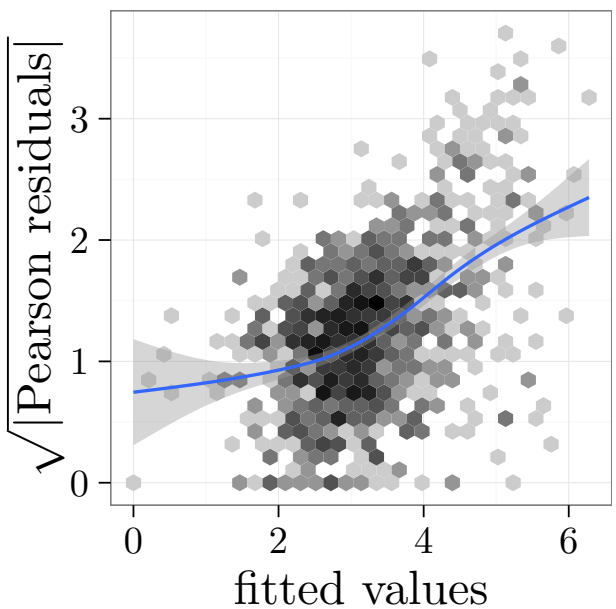
	Estimate	Std. Error	z value	Pr(>|z|)
ad1	0.32	0.03	9.90	4.3e−23
discount	−0.08	0.02	−4.43	9.4e−06
discountSEK	0.42	0.06	7.01	2.4e−12

Question: Why does discount have the "wrong" sign? Why is it significant?

Diagnostic plot







Quasi Poisson

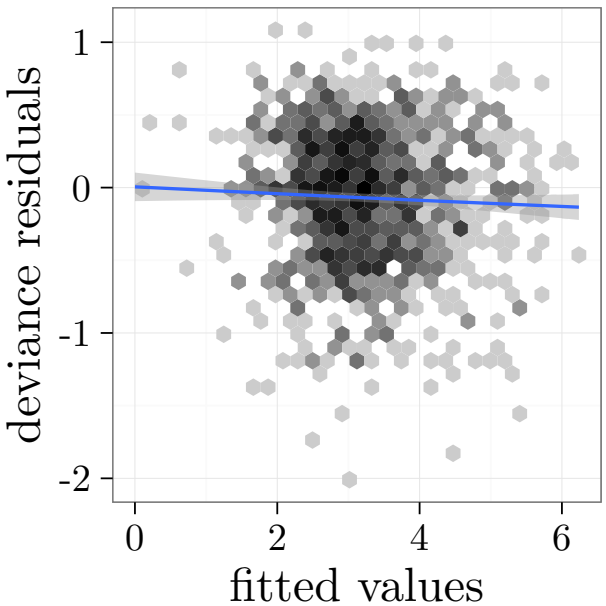
```
vegetablesGlm2 <- glm(form,
                      family = quasipoisson,
                      data = vegetables)
```

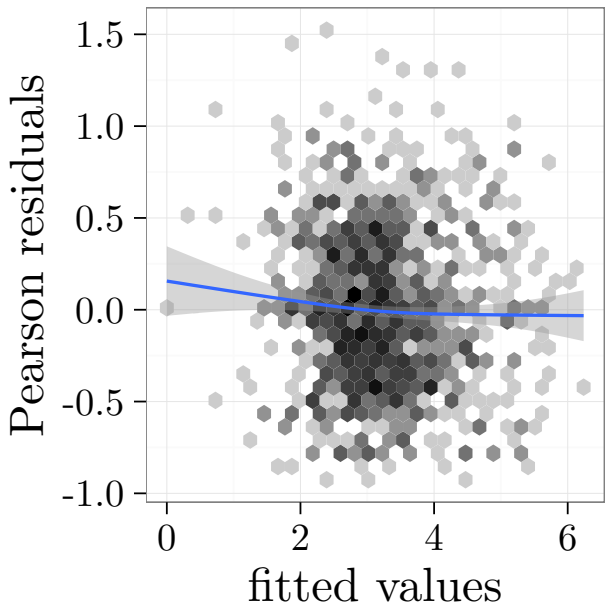
	Estimate	Std. Error	t value	Pr(>|t|)
ad1	0.32	0.11	2.89	0.004
discount	−0.08	0.06	−1.29	0.2
discountSEK	0.42	0.21	2.04	0.041

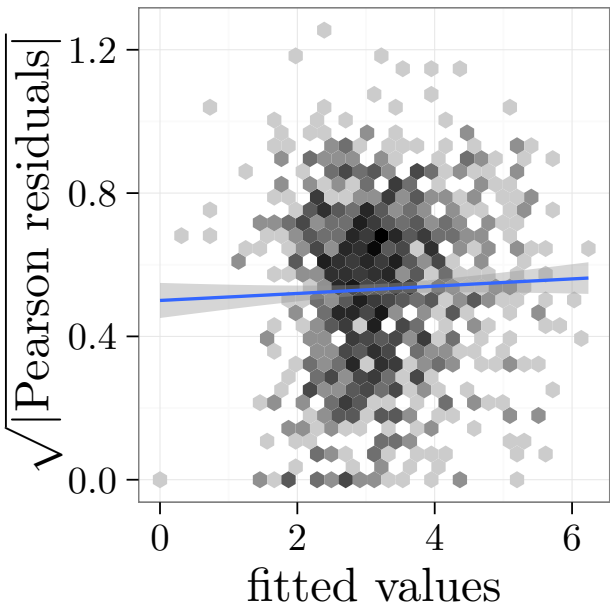
Gamma log-linear model

```
form <- sale ~ offset(log(normalSale)) + store  + ad +
  ns(discount, knots = c(20, 30, 40),
     Boundary.knots = c(0, 50)) - 1

vegetablesGlm3 <- glm(form,
                      family = Gamma("log"),
                      data = vegetables)
```

Diagnostic plot – Gamma model







Reporting the model