Non-linear models

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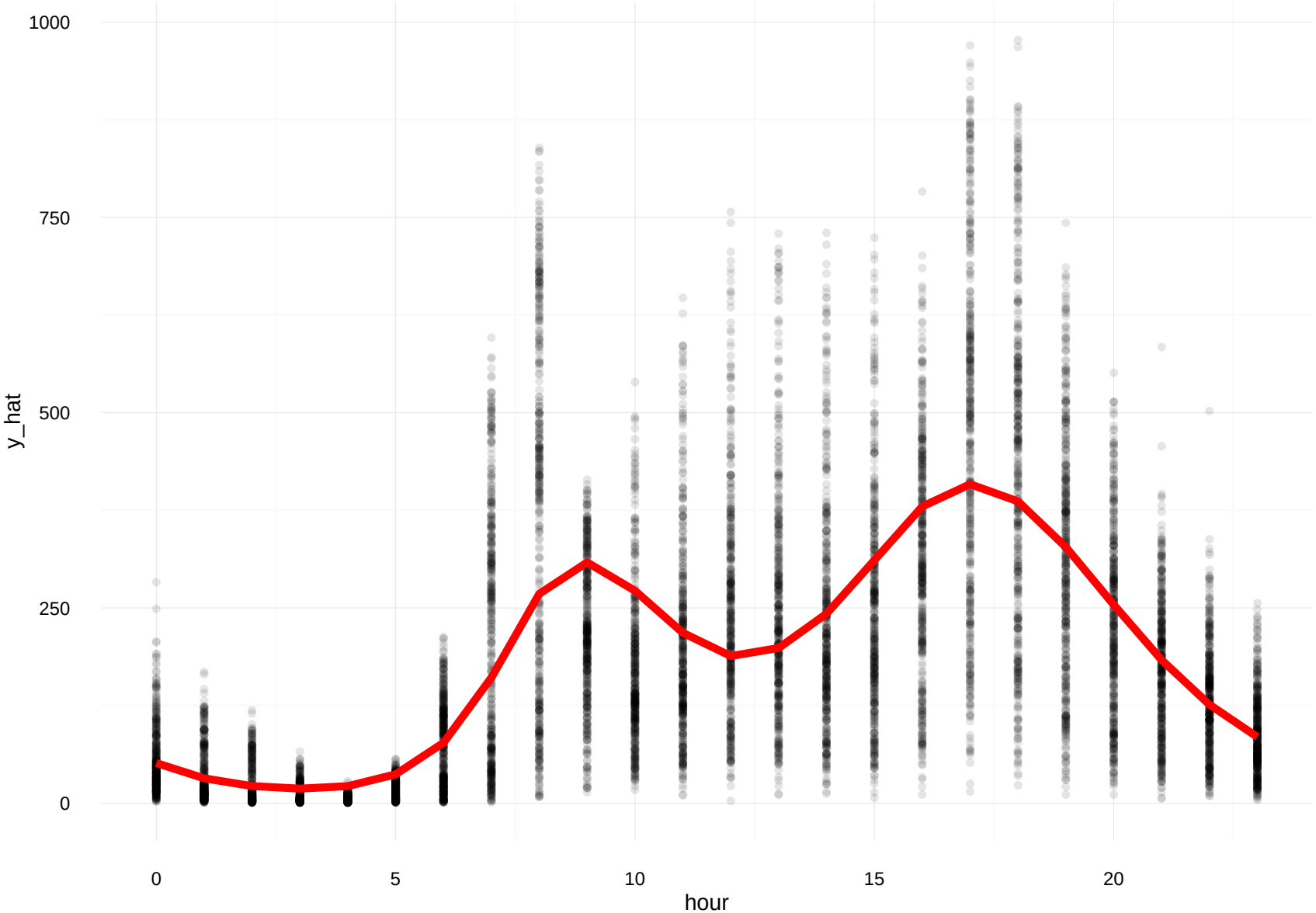
Spline of hour

```
ex_1 <- glm(count ~ ns(hour, 6), data = train,
            family = quasipoisson)
newdata <- data.frame(hour = 0:23)
newdata$y_hat <- predict(ex_1, newdata = newdata,
                         type = "response")

ggplot(newdata, aes(x = hour, y = y_hat)) +
  geom_point(data = train, aes(x = hour, y = count),
             alpha = 0.1) +
  geom_line(color = "red", size = 2) +
  theme_minimal()
```

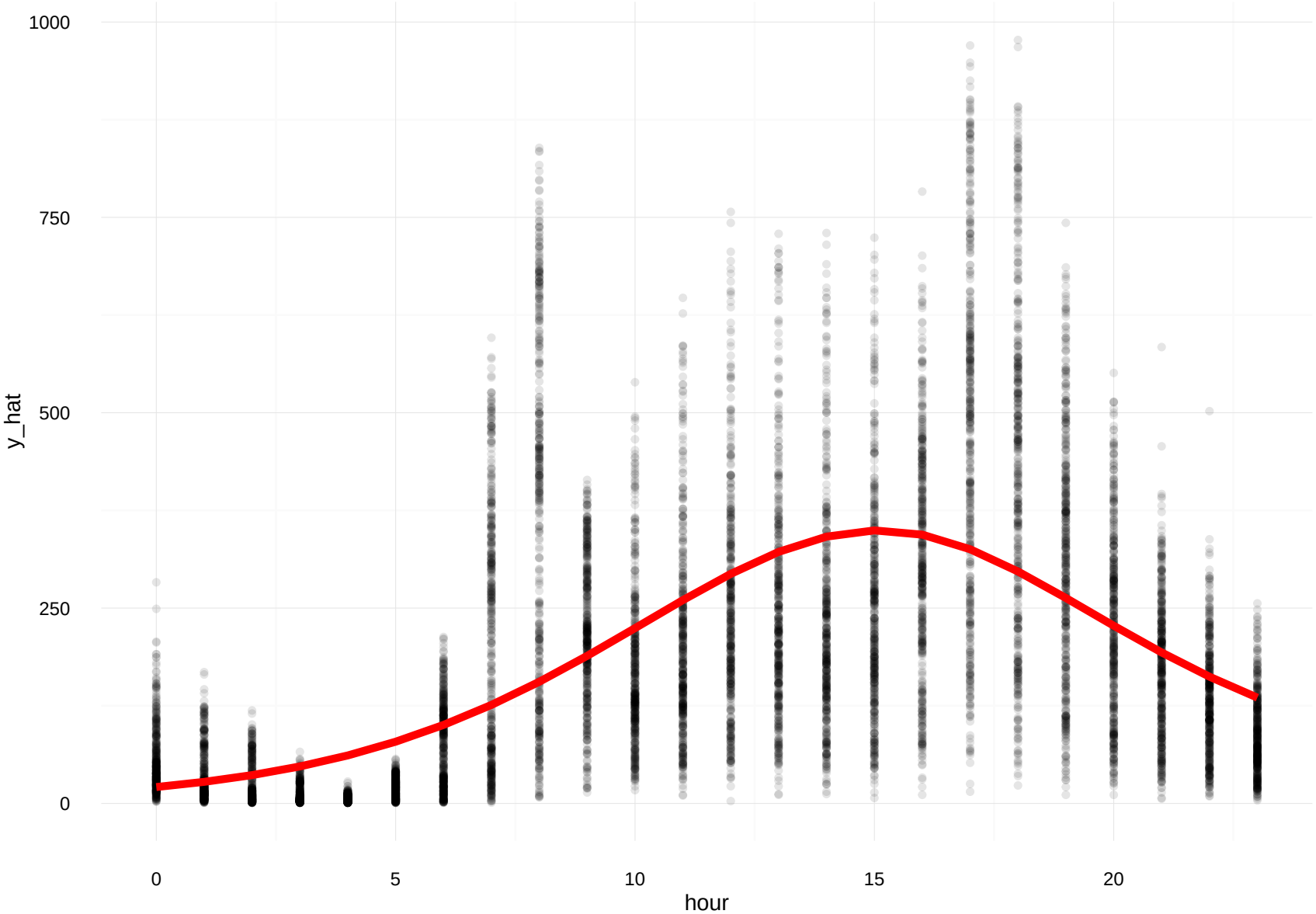
Spline of hour

Degrees of freedom: 6



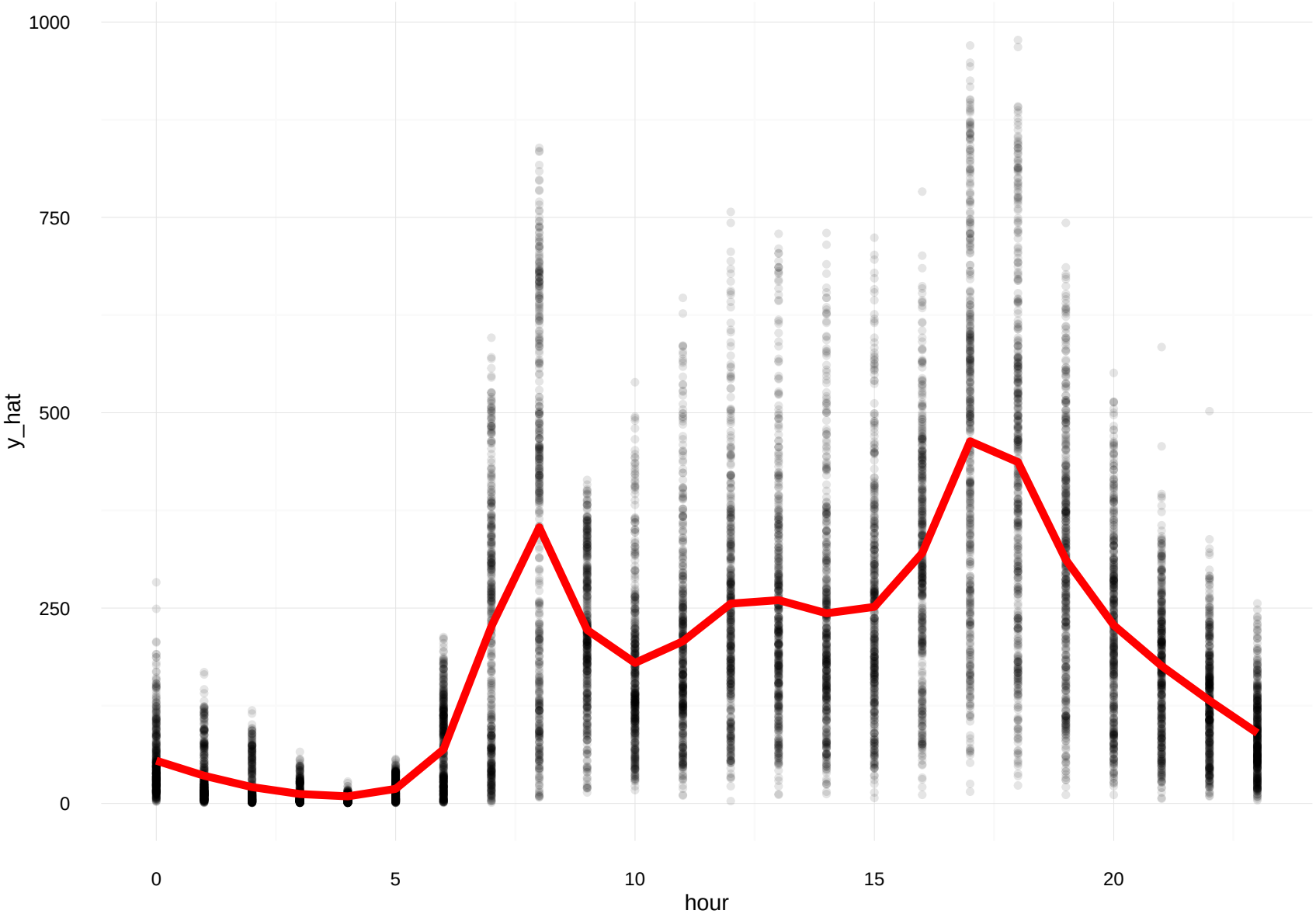
Spline of hour

Degrees of freedom: 3



Spline of hour

Degrees of freedom: 15

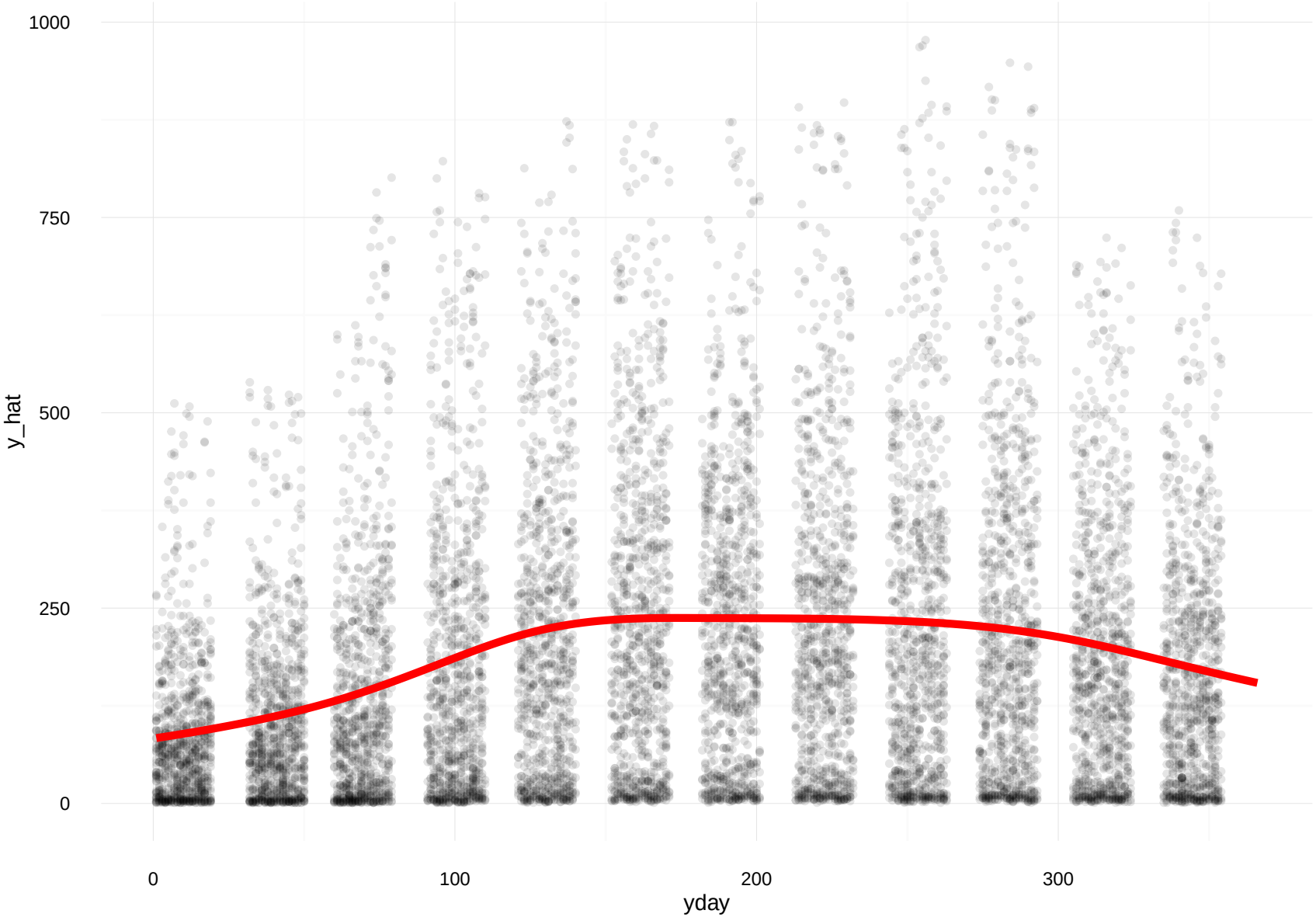


Spline of day of year

```
ex_1 <- glm(count ~ ns(yday, 6), data = train,
            family = quasipoisson)
newdata <- data.frame(yday = 1:366)
newdata$y_hat <- predict(ex_1, newdata = newdata,
                         type = "response")

ggplot(newdata, aes(x = yday, y = y_hat)) +
  geom_point(data = train, aes(x = yday, y = count),
             alpha = 0.1) +
  geom_line(color = "red", size = 2) +
  theme_minimal()
```

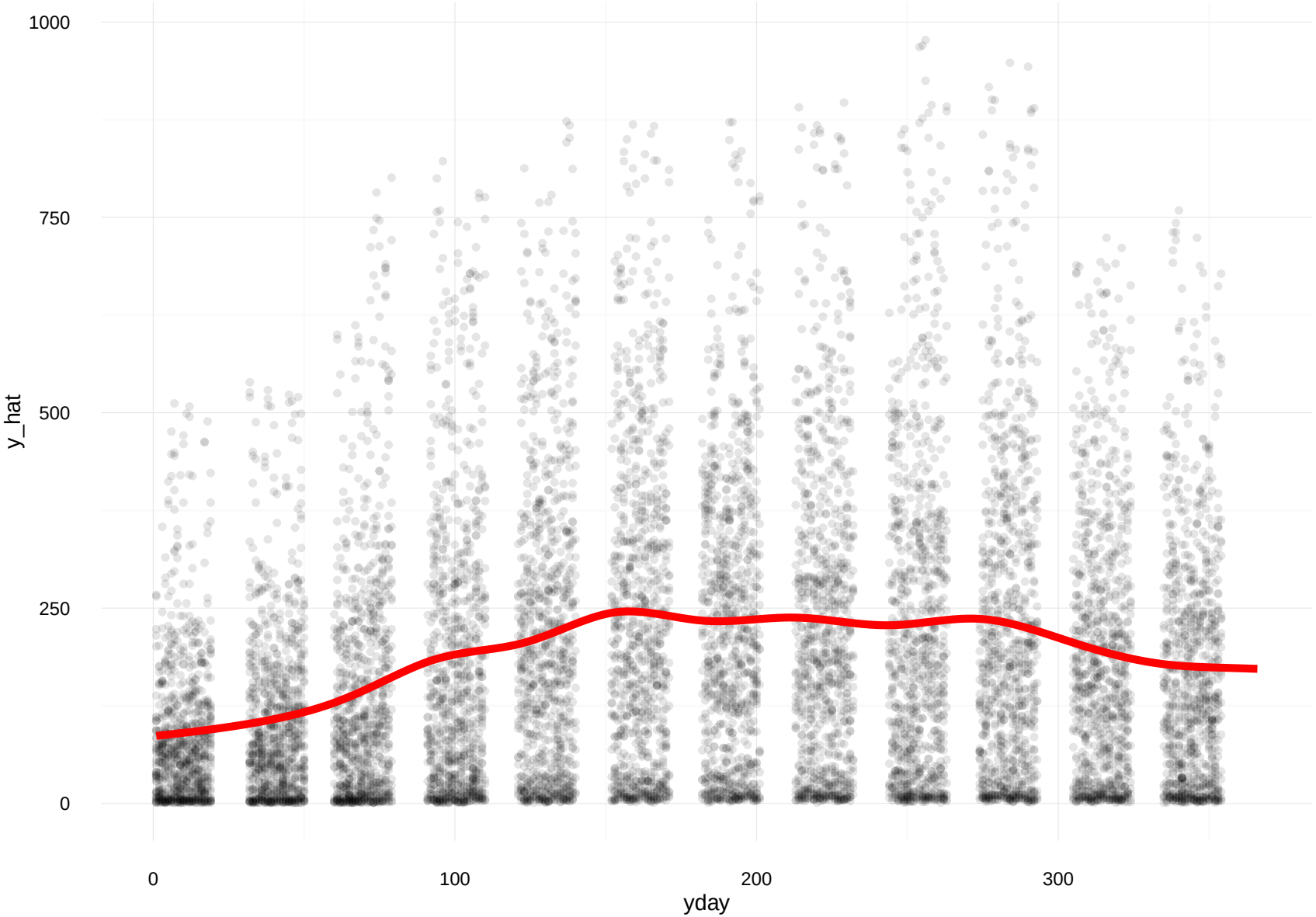
Spline of day of year

Degrees of freedom: 6



Spline of day of year

Degrees of freedom: 12



Model

On Kaggle: 0.77821.

```
mod_1 <- glm(count ~ ns(hour, 12) + ns(yday, 6),
             data = train, family = quasipoisson)

train_preds <- predict(mod_1, type = "response")
actual_preds <- train$count
rmsle(train_preds, actual_preds)
```

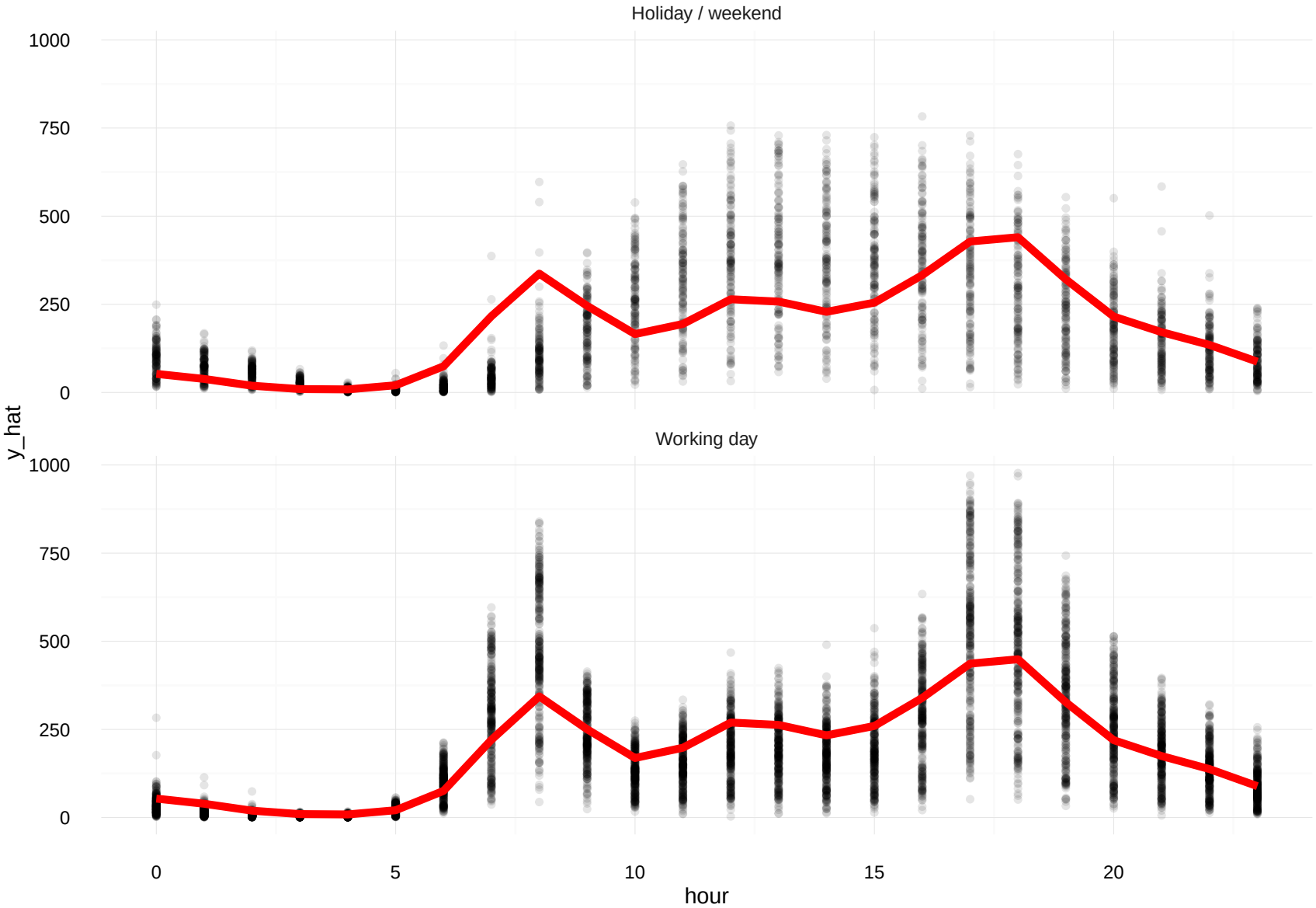
```
## [1] 0.7103122
```

```
test_preds <- predict(mod_1, newdata = test,
                      type = "response")
write_test_preds(test_preds, mod_name = "gam_1")
```

Spline of hour

```
ex_2 <- glm(count ~ workingday + ns(hour, 12),
            data = train,
            family = quasipoisson)
newdata <- data.frame(hour = rep(0:23, 2),
            workingday = rep(unique(train$workingday),
                                        each = 24))
newdata$y_hat <- predict(ex_2, newdata = newdata,
                         type = "response")

ggplot(newdata, aes(x = hour, y = y_hat)) +
  geom_point(data = train, aes(x = hour, y = count),
             alpha = 0.1) +
  geom_line(color = "red", size = 2) +
  facet_wrap(~ workingday, ncol = 1) +
  theme_minimal()
```

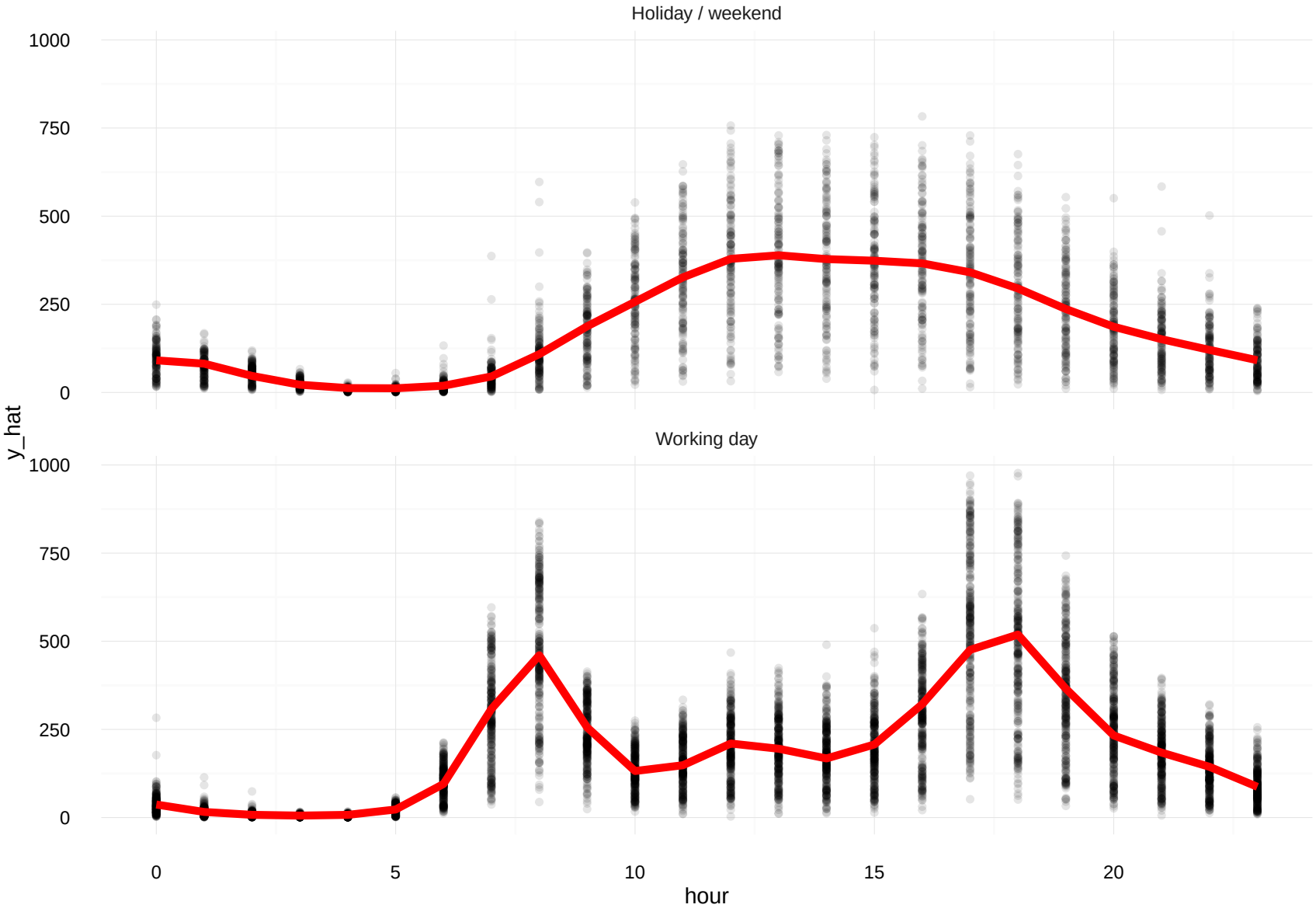
Spline of hour



Spline of hour

```
ex_2 <- glm(count ~ workingday*ns(hour, 12),
            data = train,
            family = quasipoisson)
newdata <- data.frame(hour = rep(0:23, 2),
            workingday = rep(unique(train$workingday),
                                        each = 24))
newdata$y_hat <- predict(ex_2, newdata = newdata,
                         type = "response")

ggplot(newdata, aes(x = hour, y = y_hat)) +
  geom_point(data = train, aes(x = hour, y = count),
             alpha = 0.1) +
  geom_line(color = "red", size = 2) +
  facet_wrap(~ workingday, ncol = 1) +
  theme_minimal()
```

Spline of hour



Model

On Kaggle: 0.60629.

```
mod_2 <- glm(count ~ workingday * ns(hour, 12) +
                  ns(yday, 6),
                data = train, family = quasipoisson)

train_preds <- predict(mod_2, type = "response")
actual_preds <- train$count
rmsle(train_preds, actual_preds)
```

```
## [1] 0.509331
```

```
test_preds <- predict(mod_2, newdata = test,
                      type = "response")
write_test_preds(test_preds, mod_name = "gam_2")
```

Spline of hour

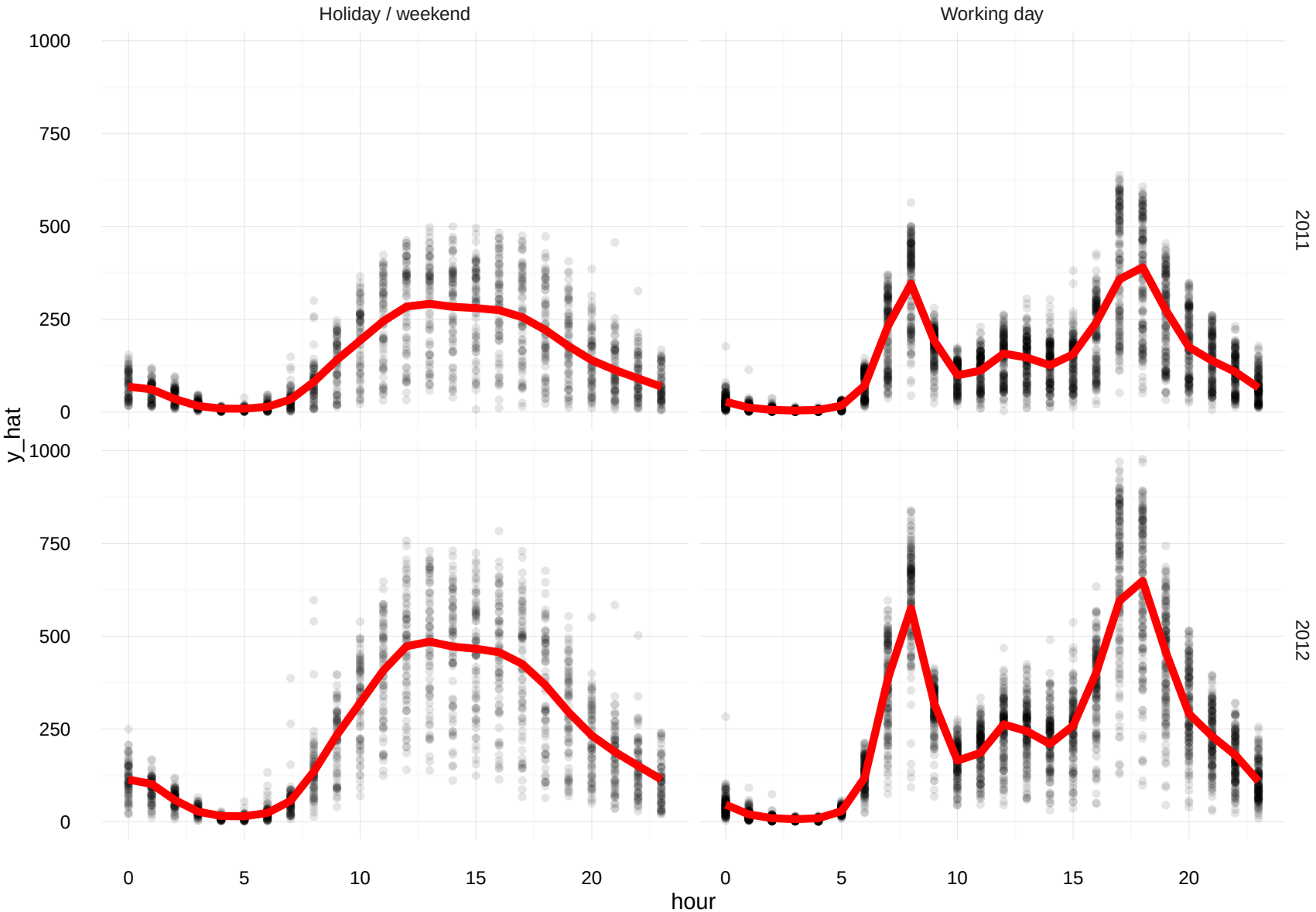
```
ex_3 <- glm(count ~ year + workingday*ns(hour, 12),
            data = train,
            family = quasipoisson)

new_hour <- 0:23
new_workingday <- levels(train$workingday)
new_year <- unique(train$year)

newdata <- expand.grid(new_hour, new_workingday, new_year)
colnames(newdata) <- c("hour", "workingday", "year")
head(newdata, 3)
```

```
##   hour         workingday year
## 1    0 Holiday / weekend 2011
## 2    1 Holiday / weekend 2011
## 3    2 Holiday / weekend 2011
```

Spline of hour

```
newdata$y_hat <- predict(ex_3, newdata = newdata,
                         type = "response")

ggplot(newdata, aes(x = hour, y = y_hat)) +
  geom_point(data = train, aes(x = hour, y = count),
             alpha = 0.1) +
  geom_line(color = "red", size = 2) +
  facet_grid(year~ workingday) +
  theme_minimal()
```

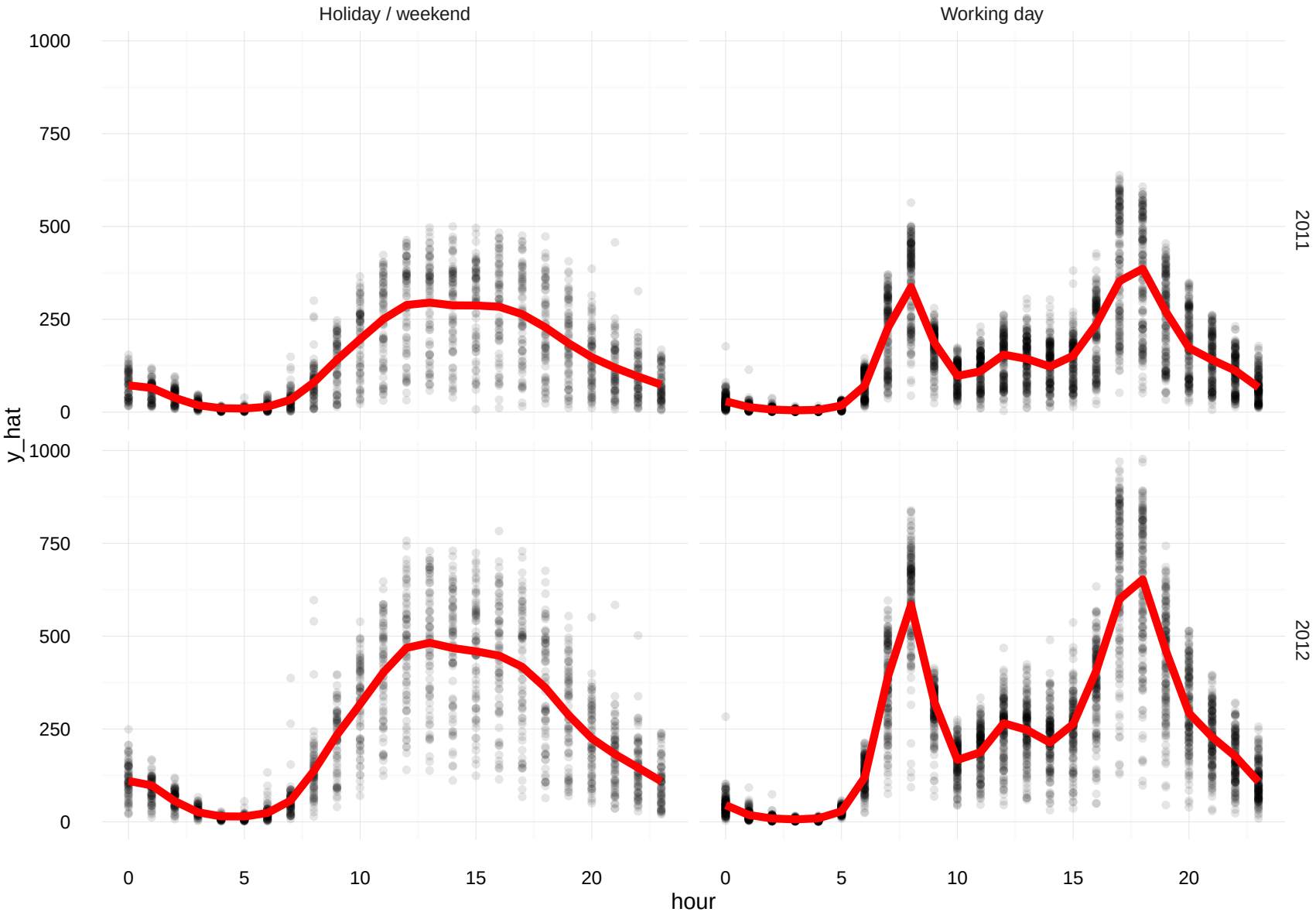
Spline of hour



Spline of hour

```
ex_4 <- glm(count ~ year*workingday*ns(hour, 12),
            data = train,
            family = quasipoisson)

new_hour <- 0:23
new_workingday <- levels(train$workingday)
new_year <- unique(train$year)

newdata <- expand.grid(new_hour, new_workingday, new_year)
colnames(newdata) <- c("hour", "workingday", "year")

newdata$y_hat <- predict(ex_4, newdata = newdata,
                         type = "response")
```

Spline of hour



Model

On Kaggle: 0.54972.

```
mod_3 <- glm(count ~ workingday * ns(hour, 12) +
                ns(yday, 6) + year,
              data = train, family = quasipoisson)

train_preds <- predict(mod_3, type = "response")
actual_preds <- train$count
rmsle(train_preds, actual_preds)
```

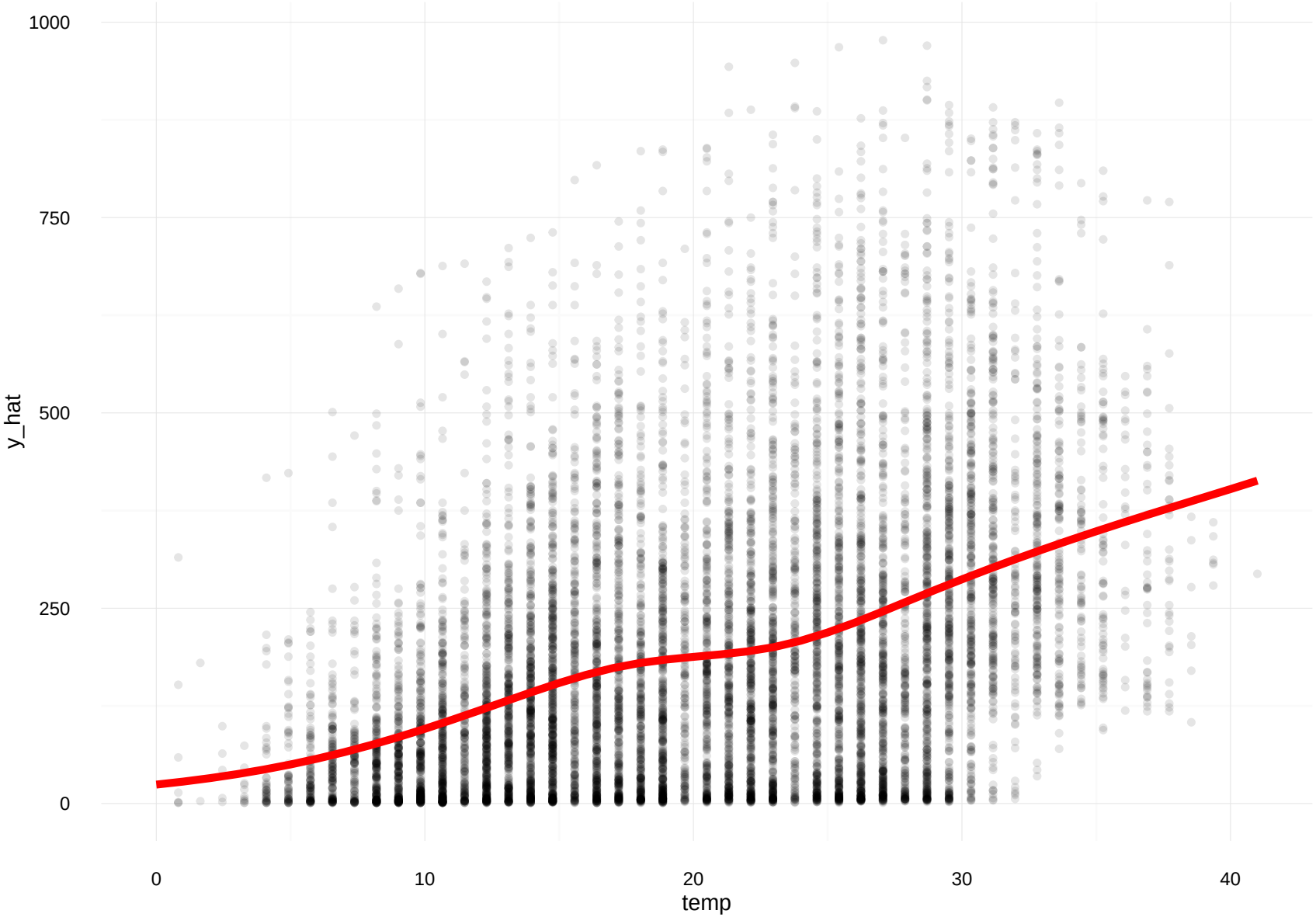
```
## [1] 0.4290578
```

```
test_preds <- predict(mod_3, newdata = test,
                      type = "response")
write_test_preds(test_preds, mod_name = "gam_3")
```

Spline of temperature

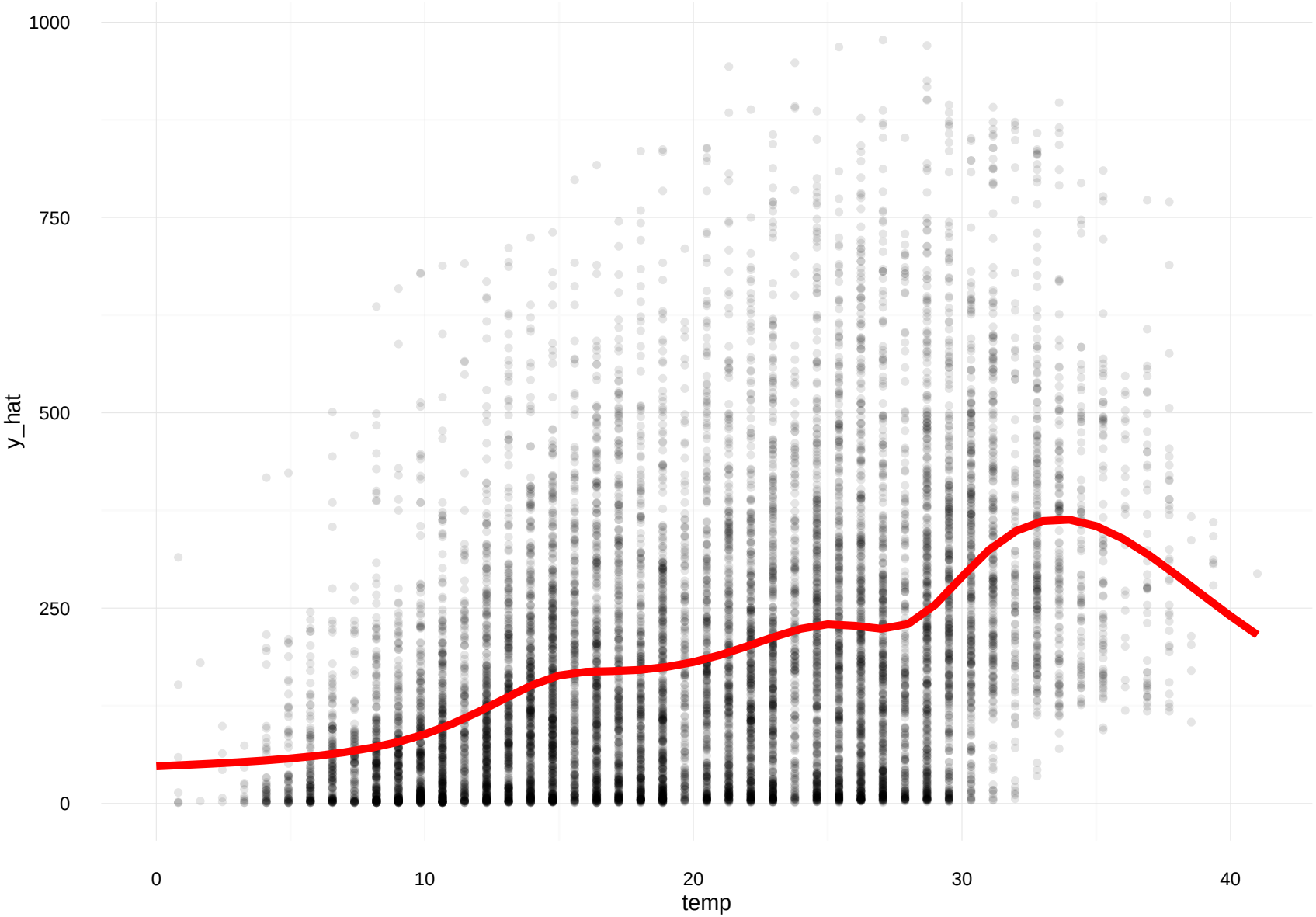
```
ex_5 <- glm(count ~ ns(temp, 5),
            data = train,
            family = quasipoisson)

newdata <- data.frame(temp = seq(from =
                                   floor(min(train$temp)),
                                 to = max(train$temp)))

newdata$y_hat <- predict(ex_5, newdata = newdata,
                         type = "response")
```

Spline of temperature



Spline of temperature

Degrees of freedom: 10.



Model

On Kaggle: 0.51936.

```
mod_4 <- glm(count ~ workingday * ns(hour, 12) +
                  ns(yday, 6) + year +
                  ns(temp, 10),
                data = train, family = quasipoisson)

train_preds <- predict(mod_4, type = "response")
actual_preds <- train$count
rmsle(train_preds, actual_preds)
```

```
## [1] 0.4137786
```

```
test_preds <- predict(mod_4, newdata = test,
                      type = "response")
write_test_preds(test_preds, mod_name = "gam_4")
```

Model

On Kaggle: 0.46740.

```
mod_5 <- glm(count ~ season * workingday * ns(hour, 12) +
               ns(yday, 6) + year +
               ns(temp, 10) + weather + wday +
               ns(humidity, 5),
             data = train, family = quasipoisson)

train_preds <- predict(mod_5, type = "response")
actual_preds <- train$count
rmsle(train_preds, actual_preds)
```

```
## [1] 0.3580469
```

```
test_preds <- predict(mod_5, newdata = test,
                      type = "response")
write_test_preds(test_preds, mod_name = "gam_5")
```

Spline of hour

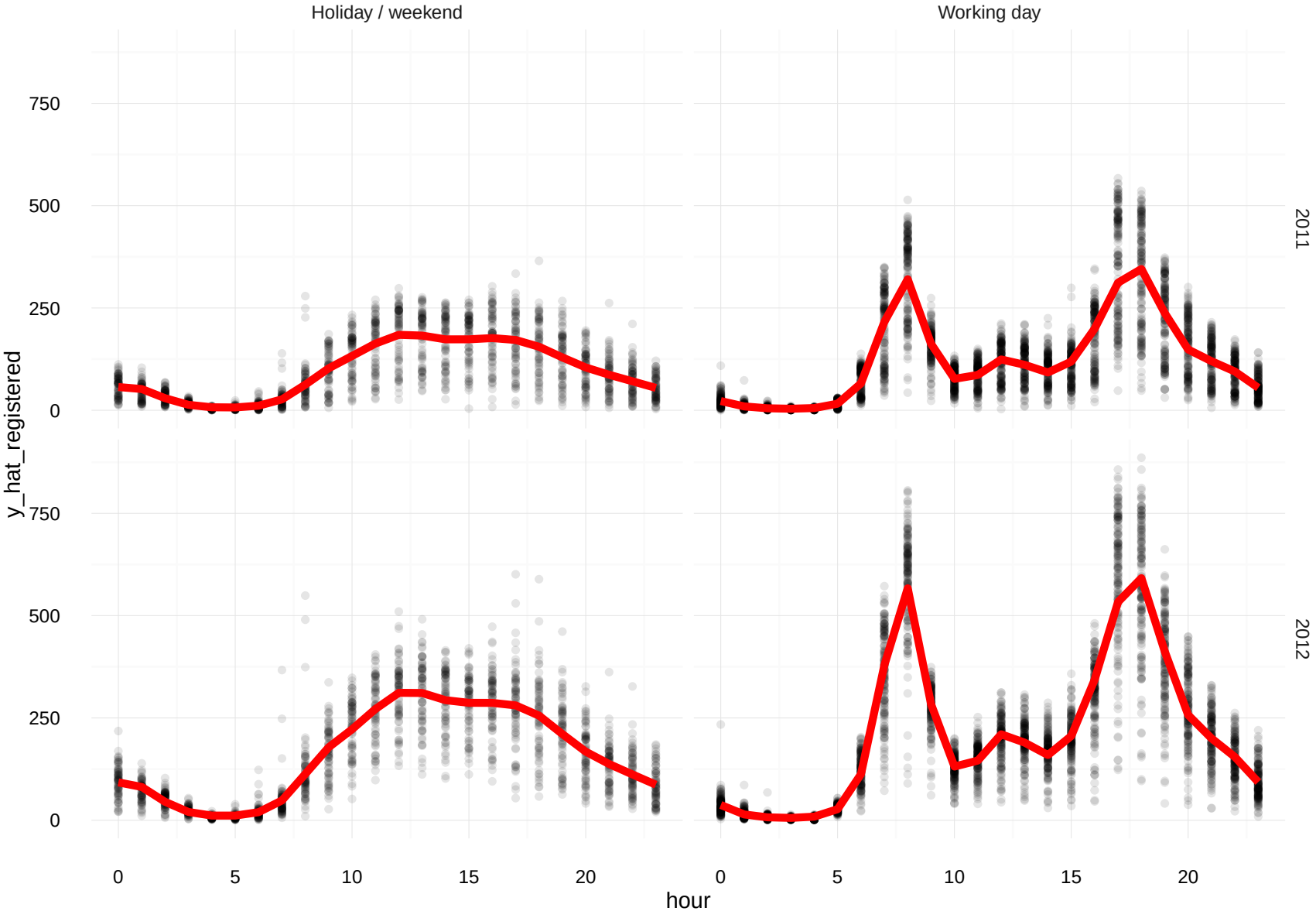
```
ex_5a <- glm(registered ~ year*workingday*ns(hour, 12),
             data = train,
             family = quasipoisson)
ex_5b <- glm(casual ~ year*workingday*ns(hour, 12),
             data = train,
             family = quasipoisson)

new_hour <- 0:23
new_workingday <- levels(train$workingday)
new_year <- unique(train$year)
```

Spline of hour

```
newdata <- expand.grid(new_hour, new_workingday,
                       new_year)
colnames(newdata) <- c("hour", "workingday", "year")

newdata$y_hat_registered <- predict(ex_5a,
                                    newdata = newdata,
                                    type = "response")
newdata$y_hat_casual <- predict(ex_5b,
                                newdata = newdata,
                                type = "response")
```

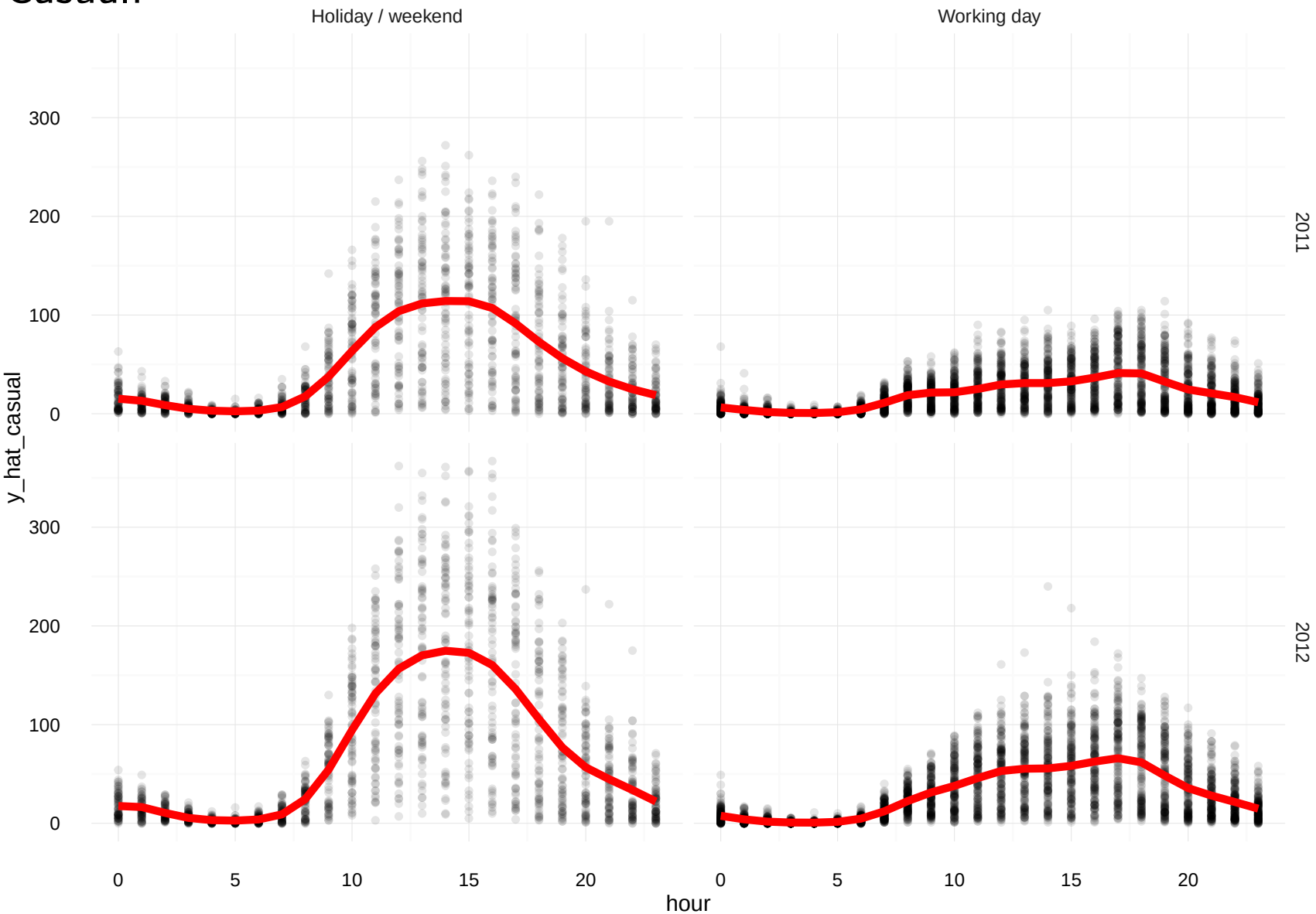
Spline of hour

Registered:



Spline of hour

Casual:



Model

```
mod_6a <- glm(registered ~ season * workingday *
                 ns(hour, 12) +
               ns(yday, 6) + year +
               ns(temp, 10) + weather + wday +
               ns(humidity, 5),
             data = train, family = quasipoisson)
mod_6b <- glm(casual ~ season * workingday *
                 ns(hour, 12) +
               ns(yday, 6) + year +
               ns(temp, 10) + weather + wday +
               ns(humidity, 5),
             data = train, family = quasipoisson)
```

Model

On Kaggle: 0.47690.

```
train_predsa <- predict(mod_6a, type = "response")
train_predsb <- predict(mod_6b, type = "response")
train_preds <- train_predsa + train_predsb
actual_preds <- train$count
rmsle(train_preds, actual_preds)
```

```
## [1] 0.3555703
```

```
test_predsa <- predict(mod_6a, newdata = test,
                       type = "response")
test_predsb <- predict(mod_6b, newdata = test,
                       type = "response")
test_preds <- test_predsa + test_predsb
write_test_preds(test_preds, mod_name = "gam_6")
```

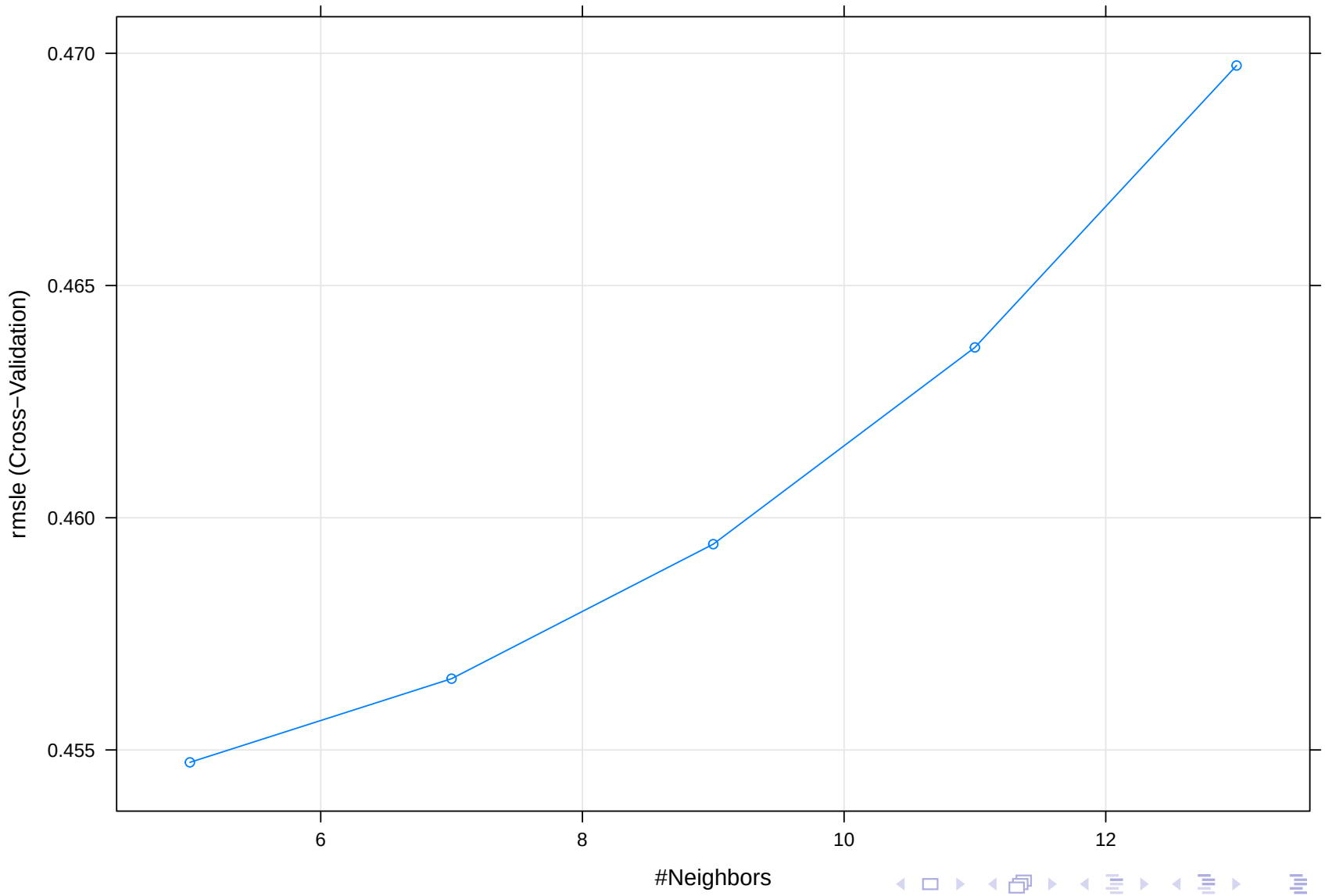
K-nearest neighbors

```
set.seed(825)
mod_1 <- train(count ~ temp + hour +
                 workingday + year,
               data = train,
               method = "knn",
               trControl = fitControl,
               metric = "rmsle",
               maximize = FALSE,
               preProcess = c("center", "scale",
                              "spatialSign"),
               tuneLength = 5)

train_preds <- predict(mod_1,
                       newdata = train)
rmsle(train_preds, train$count)
```

```
## [1] 0.3958522
```

K-nearest neighbors

```
plot(mod_1)
```



K-nearest neighbors

On Kaggle: 0.49535.

```
test_preds <- predict(mod_1, newdata = test)
write_test_preds(test_preds, mod_name = "knn")
```

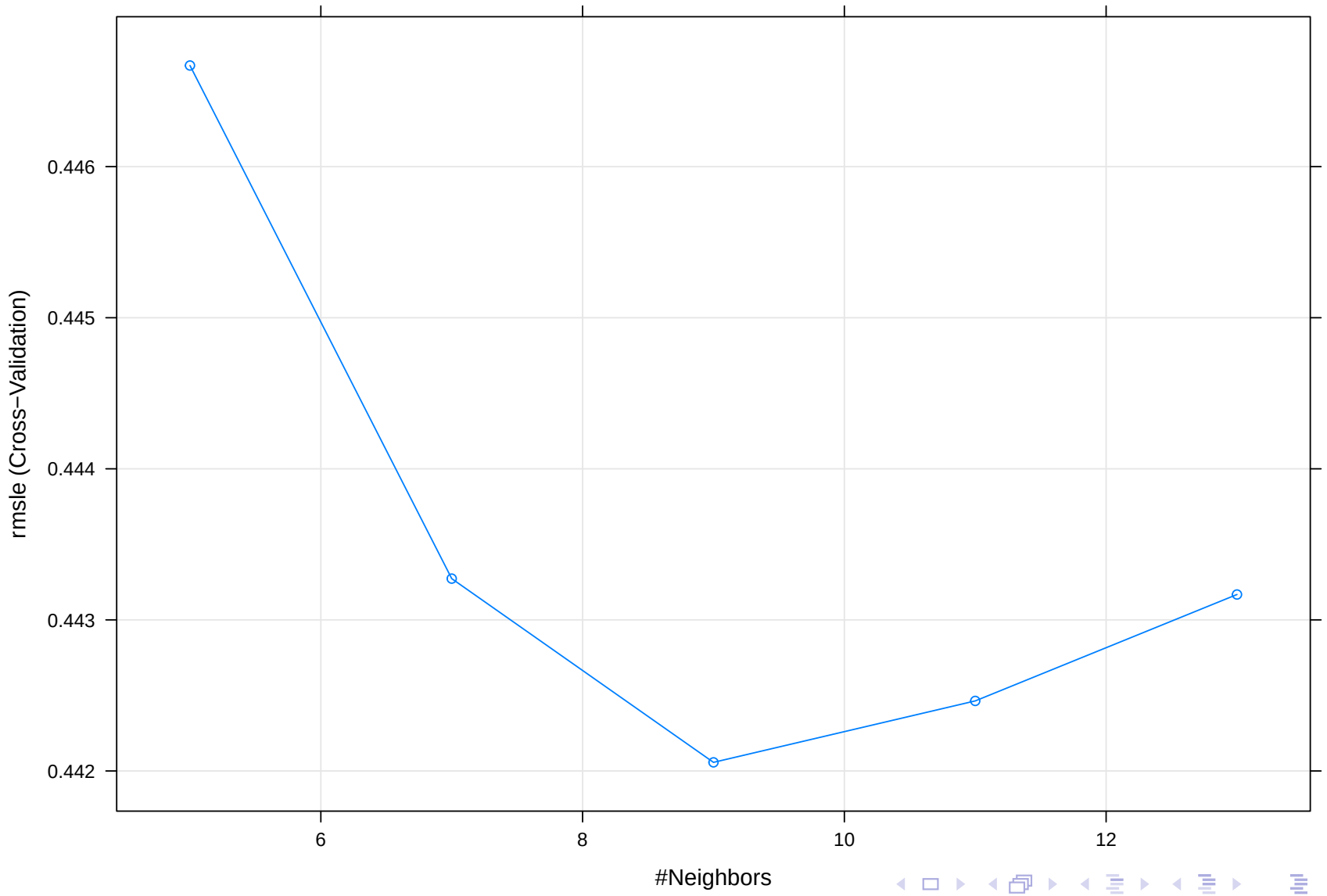
K-nearest neighbors

```
set.seed(825)
mod_2 <- train(count ~ temp + factor(hour) + workingday + y
               data = train,
               method = "knn",
               trControl = fitControl,
               metric = "rmsle",
               maximize = FALSE,
               preProcess = c("center", "scale",
                              "spatialSign"),
               tuneLength = 5)

train_preds <- predict(mod_2, newdata = train)
rmsle(train_preds, train$count)
```

```
## [1] 0.4080661
```

K-nearest neighbors

```
plot(mod_2)
```



K-nearest neighbors

On Kaggle: 0.48618.

```
test_preds <- predict(mod_2, newdata = test)
write_test_preds(test_preds, mod_name = "knn2")
```

SVM

```
set.seed(825)
mod_3 <- train(log(count) ~ temp + hour +
                 workingday + year,
               data = train,
               method = "svmRadial",
               trControl = fitControl,
               metric = "rmsle",
               maximize = FALSE,
               preProcess = c("center", "scale",
                              "spatialSign"),
               tuneLength = 5)

train_preds <- exp(predict(mod_3,
                           newdata = train))
rmsle(train_preds, train$count)
```

```
## [1] 0.7620723
```

SVM

On Kaggle: 0.77061.

```
test_preds <- exp(predict(mod_3, newdata = test))
write_test_preds(test_preds, mod_name = "svm")
```