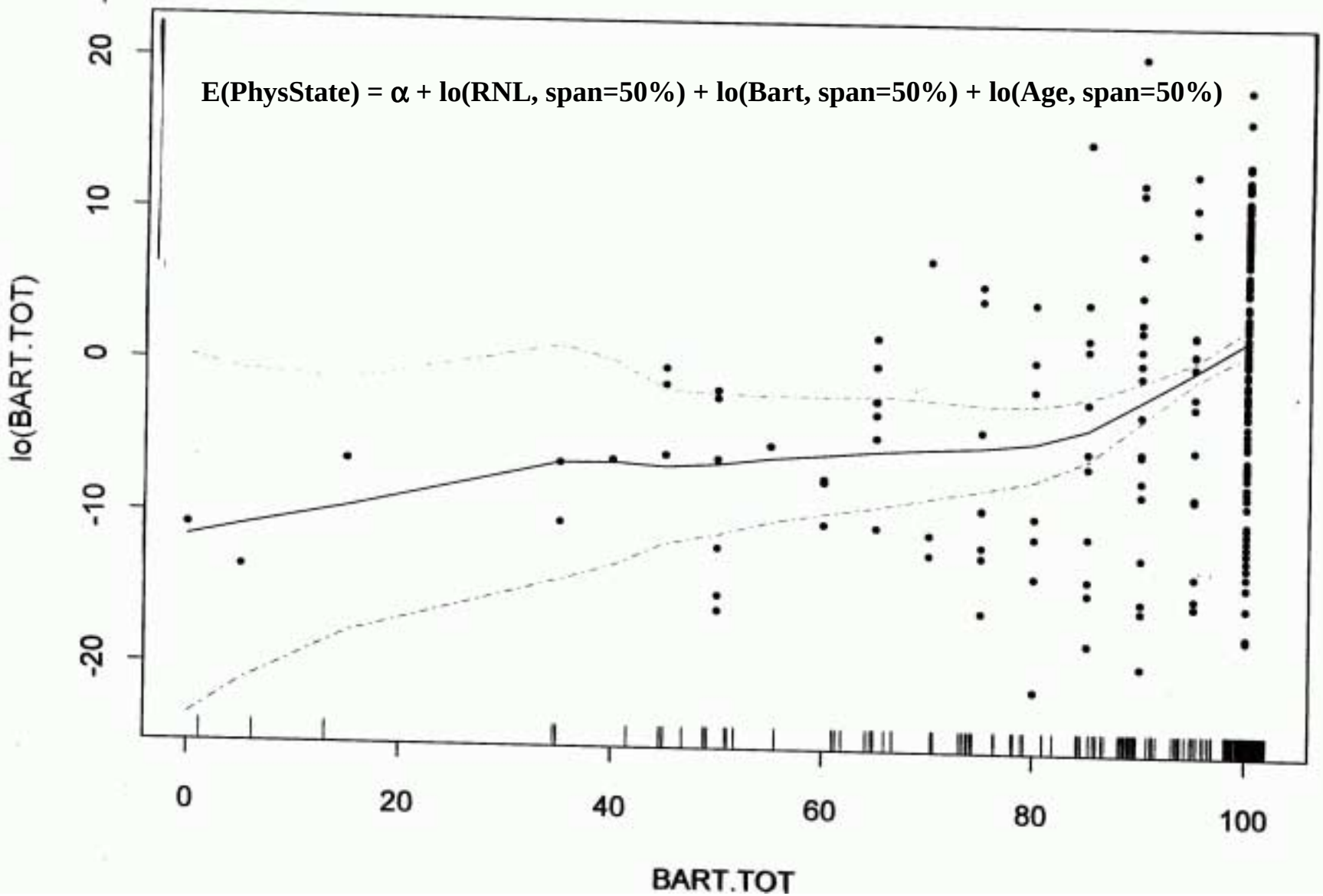
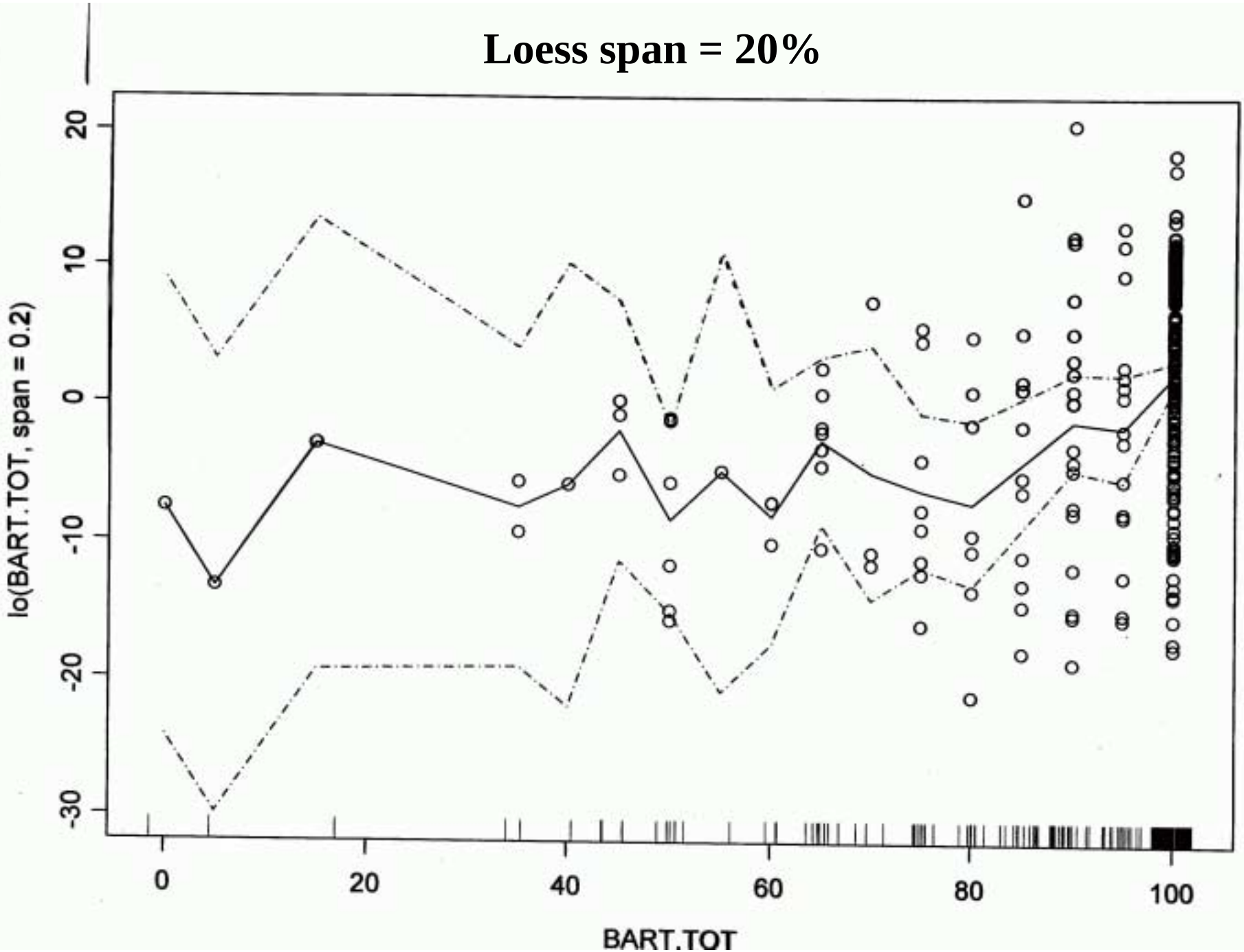
Locally Weighted Smooth Regression (LOESS), Span = 50%

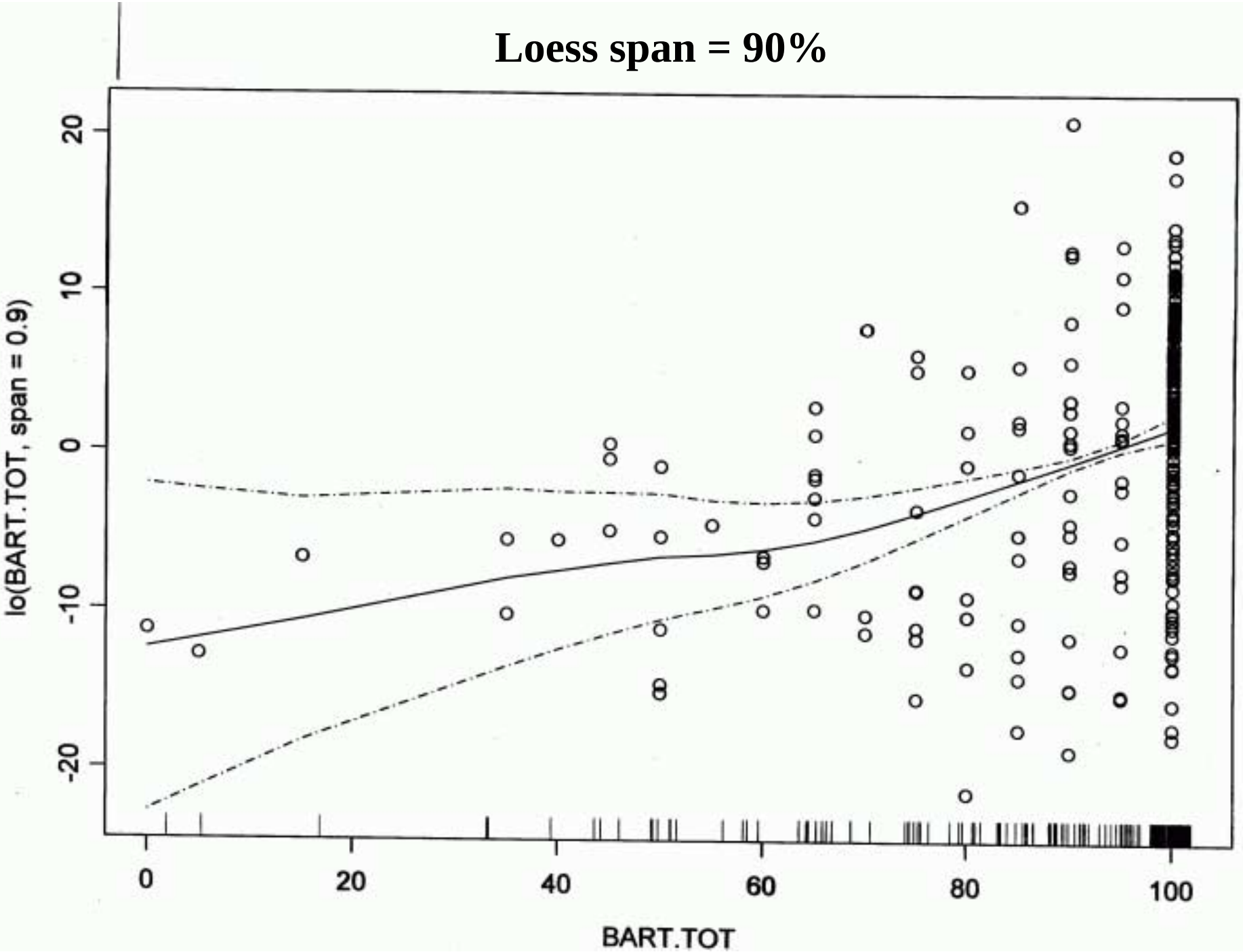


- **GAM model :**
  - $E(y) = \alpha + lo(RNL) + lo(Bart) + lo(Age)$
- **Partial residuals :**
  - $lo(Bart) = E(y) - \alpha - lo(RNL) - lo(Age)$

Loess span = 20%



Loess span = 90%



Is the smooth any better than a linear term ?

Span	Term	Df	Npar Df	Npar F	Pr(F)
90%	lo(BART)	1	1.1	3.466	0.06
50%	lo(BART)	1	3	2.933	0.04
20%	lo(BART)	1	15	0.964	0.5

Hypotheses for the F test :

H_0 : Linear fit

H_1 : Non Linear better fit

Describing the GAM fit – Output from Splus

```
> names(studydt2.gam1)
 [1] "coefficients"        "residuals"           "fitted.values"  "R"
 [5] "rank"                "smooth"              "nl.df"          "df.residual"
 [9] "var"                 "assign"              "terms"          "call"
[13] "formula"             "family"              "nl.chisq"       "x"
[17] "y"                   "weights"             "iter"           "additive.predictors"
[21] "deviance"            "null.deviance"       "contrasts"
```

```
> summary(studydt2.gam1)

Call: gam(formula = PHYS.ST ~ lo(BART.TOT) + lo(RNL.TOT), data = studydt2,
          x = T, y = T)
Deviance Residuals:
       Min        1Q    Median       3Q      Max
 -19.48468 -4.880234 0.7642415 5.887523 22.87868

(Dispersion Parameter for Gaussian family taken to be 61.16281 )

    Null Deviance: 27801.96 on 239 degrees of freedom

Residual Deviance: 14123.72 on 230.92 degrees of freedom

Number of Local Scoring Iterations: 1

DF for Terms and F-values for Nonparametric Effects

             Df Npar Df   Npar F      Pr(F)
 (Intercept)  1
lo(BART.TOT)  1     3.0 2.829473 0.03995659
 lo(RNL.TOT)  1     3.1 3.331052 0.01887402
```

$\phi = \sigma^2$

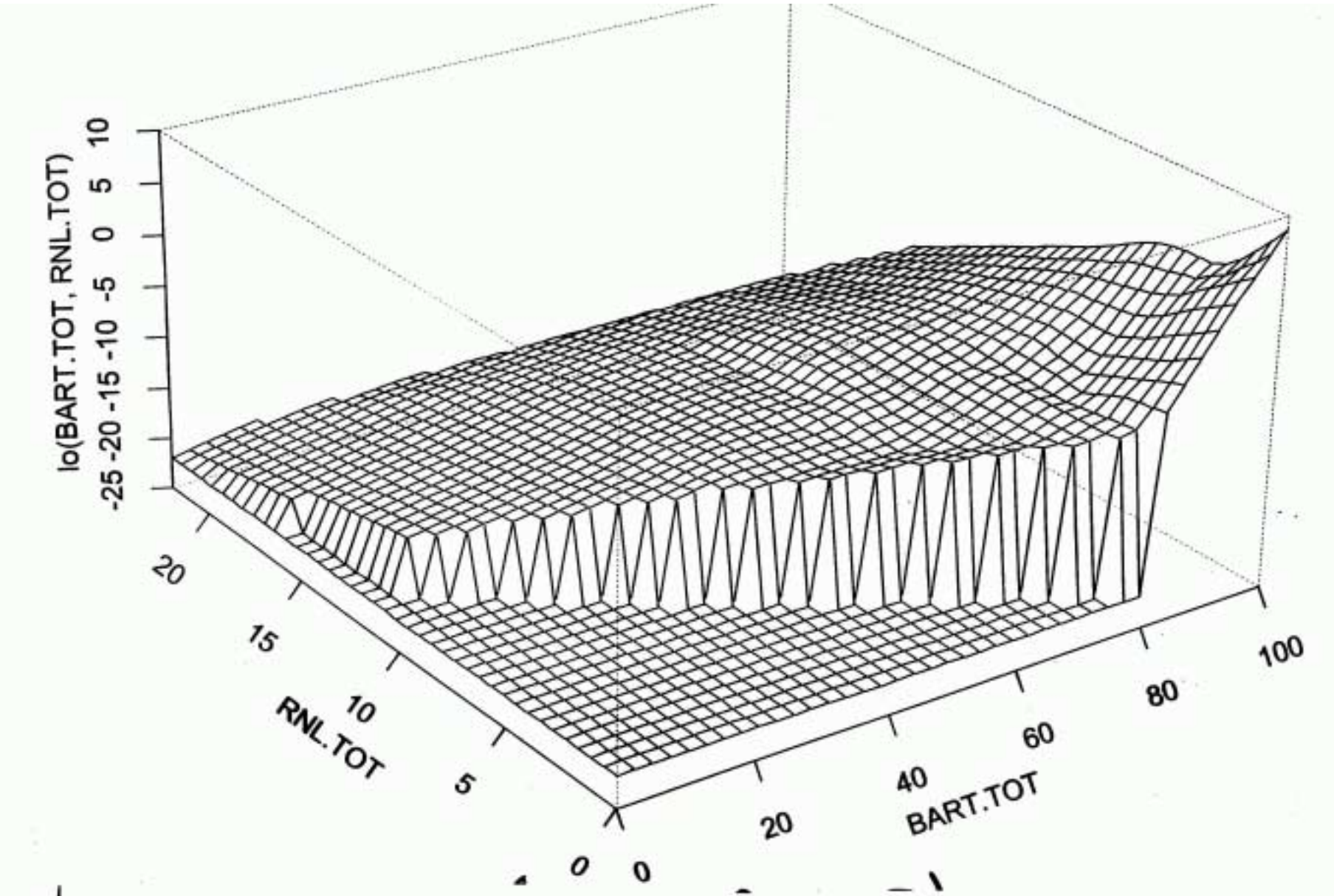
Approximate test :

H_0 : Smooth term does not improve fit over a linear one

Approximately equivalent to testing a model : **ßx + lo(x)** versus the model **ßx**

Does Lo(Bart) improve the fit of the model : E(Y) = a + lo(RNL) + Age ??

Model	Resid. Dev.	Resid. DF	Δ DF	Δ Deviance	Test
Lo(RNL) + Age	15539.3	233.9	3.96	1447	$Pr(\chi^2_{3.96df} > 1447) \approx 0$
Lo(RNL) + Age + Lo(Bart)	14092.3	229.9			



E(Phys.State) = α + lo(RNL.TOT, BART.TOT)

Locally Weighted Smooth Regression (LOESS) using 50% of the data