To-do’s from last meeting

1. Fit loglogistic AFT model
2. Extract the estimated surface from additive model
3. Apply method to real data
4. Check the FTTM paper and AOAS latex template

User-defined functions

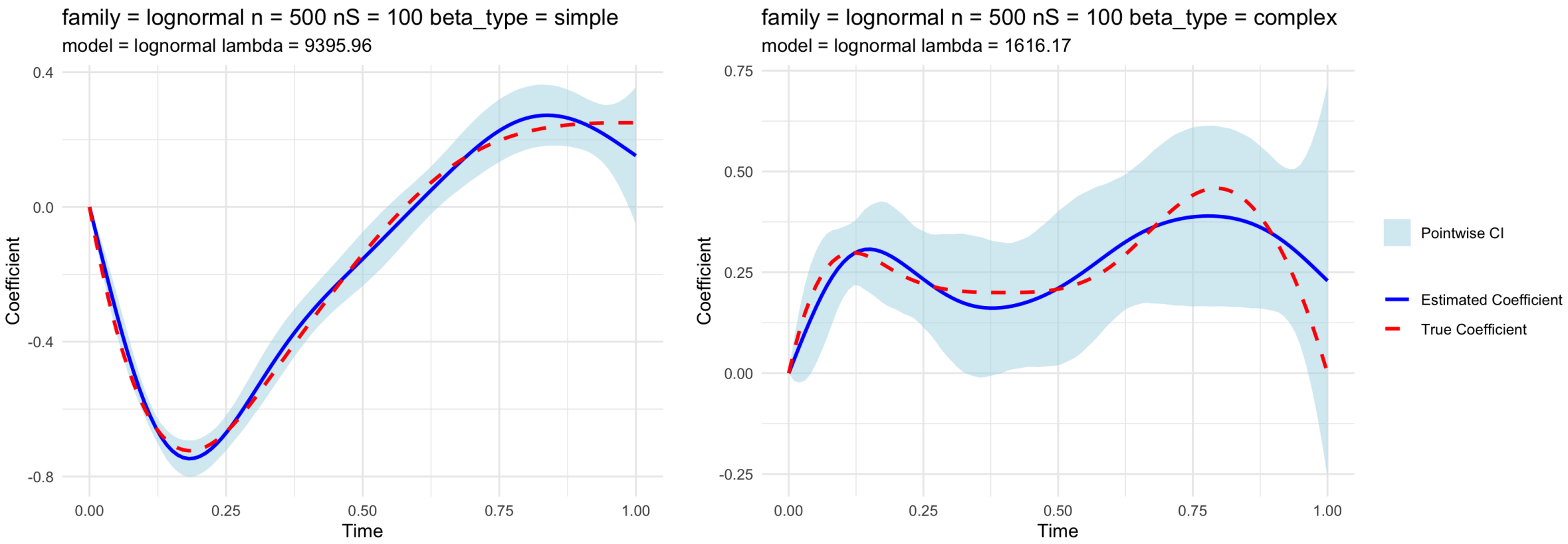
- optimize_AFT(Y, delta, X, data, family, lambda, k = 30, se = FALSE)
  - Y: survival time variable
  - delta: censoring indicator variable
  - X: functional predictor variable
  - data: name of data frame
  - family: lognormal or loglogistic
  - k: number of spline basis to construct beta1(s)
  - lambda: smoothing parameter
  - se: whether to calculate standard error and CI for parameters
- Will add Z (scalar variables)

User-defined functions

- optimize_lambda <- function(Y, delta, X, data, family, lambda_grid)
  - Perform a grid search on lambda_grid to find the optimal lambda which minimizes the GCV value

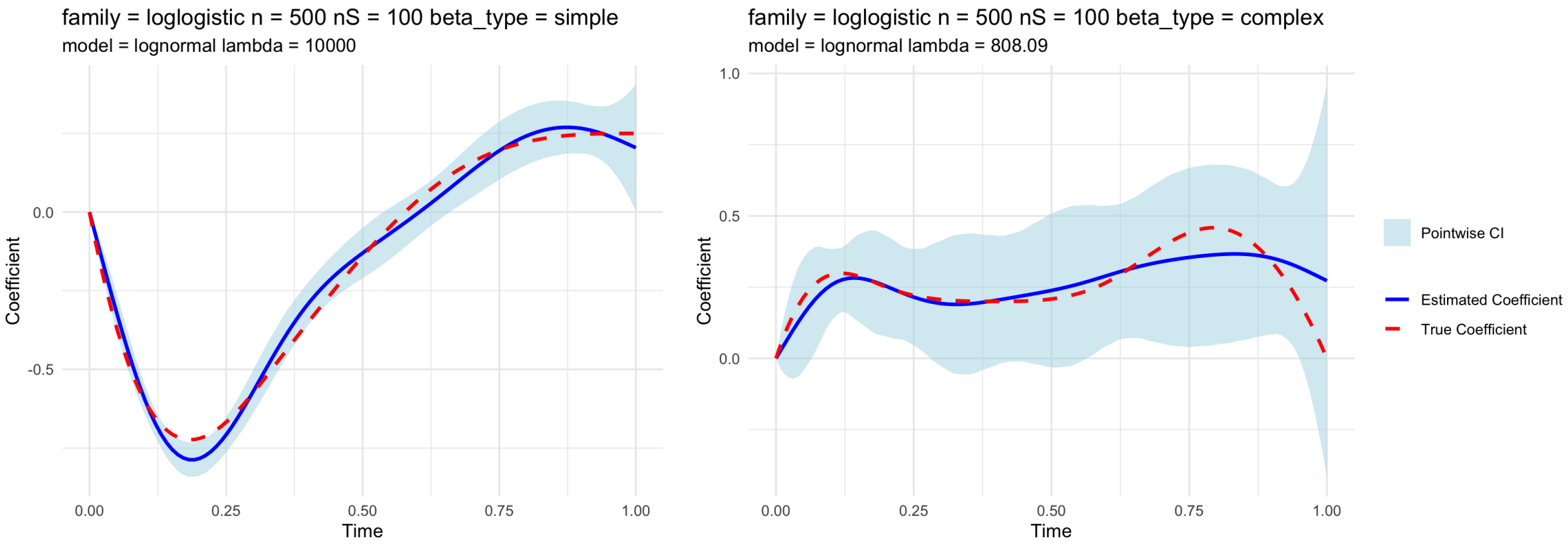
Estimated coefficient function

- True model is lognormal; estimation model is lognormal



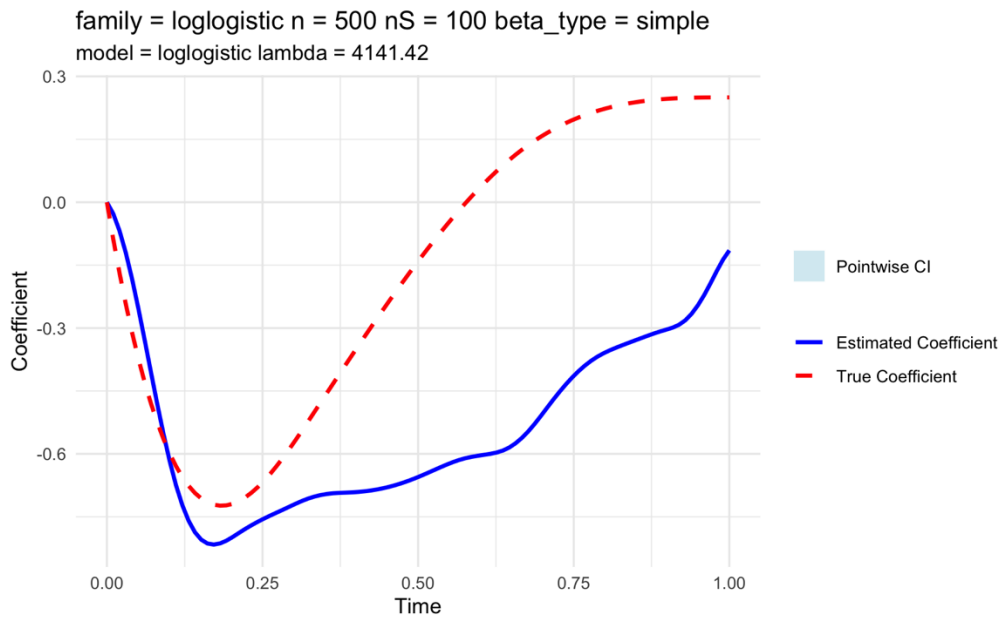
Estimated coefficient function

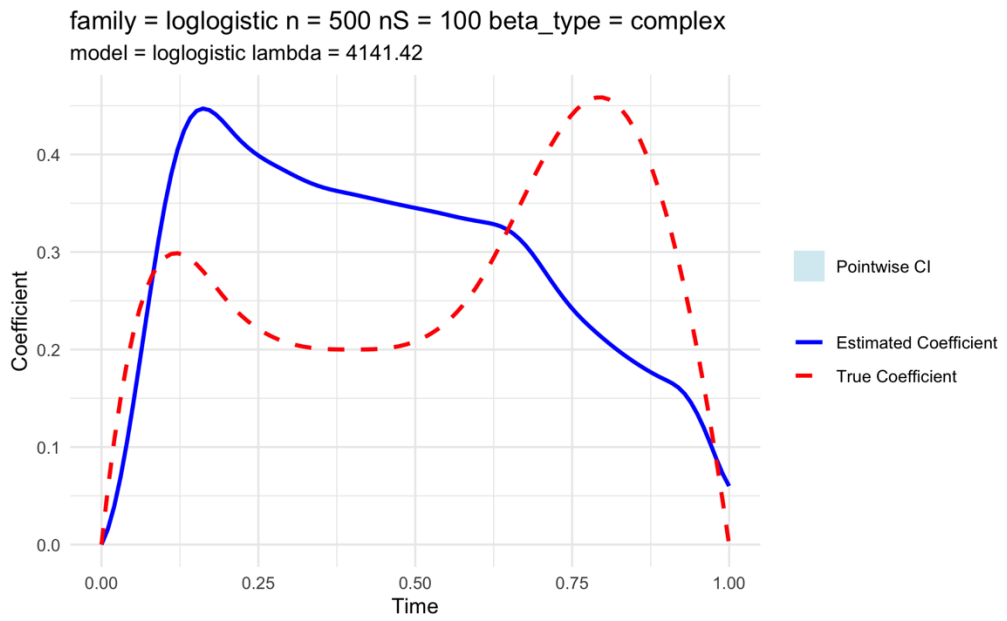
- True model is loglogistic; estimation model is lognormal



Estimated coefficient function

- True model is loglogistic; estimation model is loglogistic
- Need to troubleshoot the gradient function





- Average MISE of coefficient function across 10 iterations

b	beta_type	family	n	nS	mise_coef_norm	mise_coef_cox	mise_coef_faft
0.5	simple	lognormal	500	100	0.011	0.439	0.069
0.5	simple	loglogistic	500	100	0.035	0.063	0.123
0.5	simple	cox.ph	500	100	0.040	0.009	0.062

- Average coverage of the 95% pointwise CI of coefficient function

b	beta_type	family	n	nS	cp_coef_norm	cp_coef_cox	cp_coef_faft
0.5	simple	lognormal	500	100	0.901	0.078	0.654
0.5	simple	loglogistic	500	100	0.592	0.080	0.465
0.5	simple	cox.ph	500	100	0.014	0.828	0.716

- Potential reason for the high bias of FAFT:
  - A sparse lambda grid was used (100 grids), and model is highly sensitive to lambda…

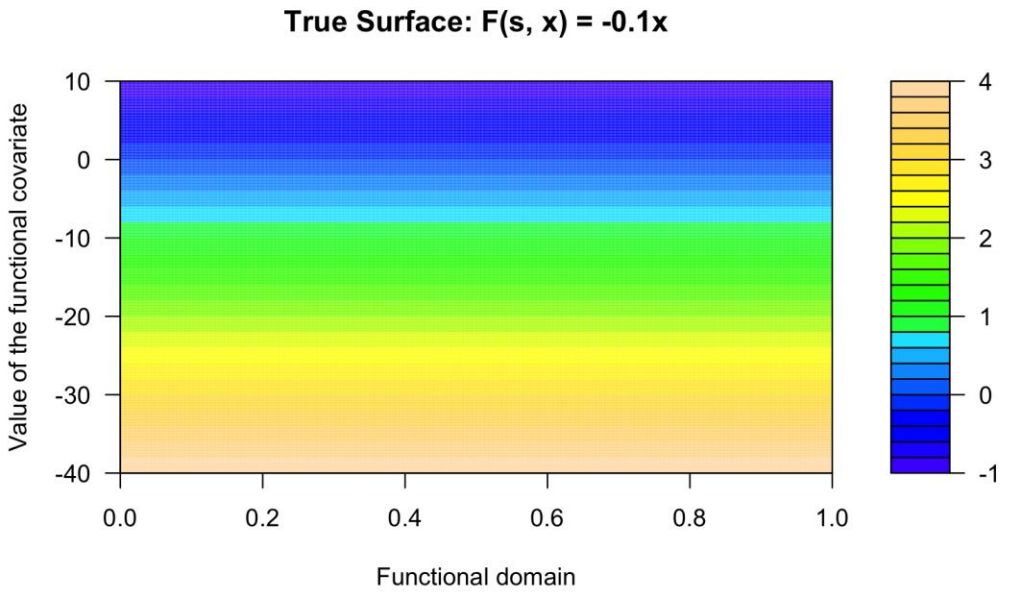
- Average Brier score across 10 iterations

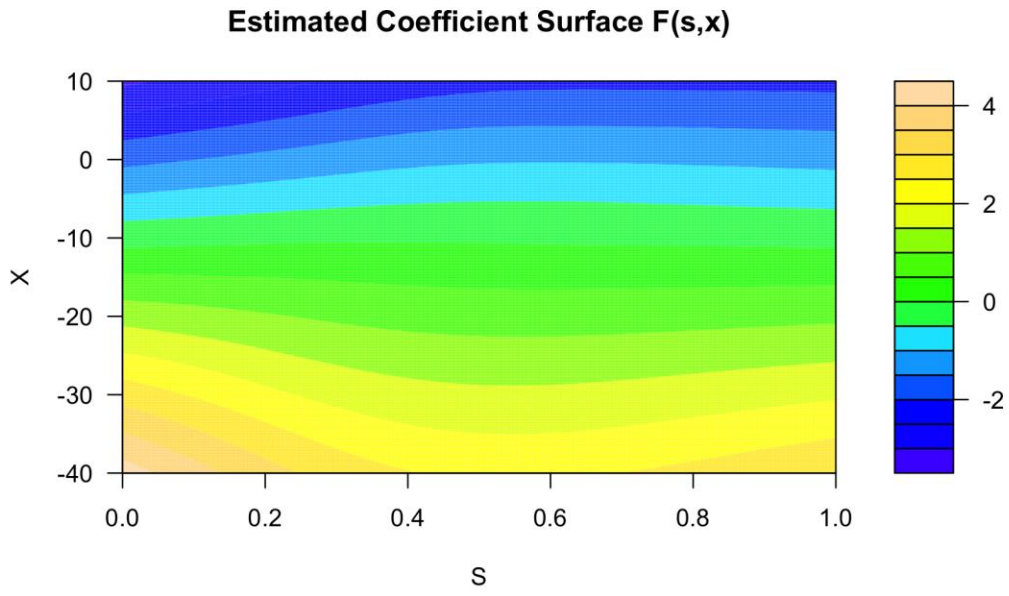
b	beta_type	family	n	nS	Brier_norm	Brier_cox	Brier_faft
0.5	simple	lognormal	500	100	0.041	0.276	0.271
0.5	simple	loglogistic	500	100	0.070	0.184	0.244
0.5	simple	cox.ph	500	100	0.056	0.103	0.190

- Average MISE of survival function across 10 iterations

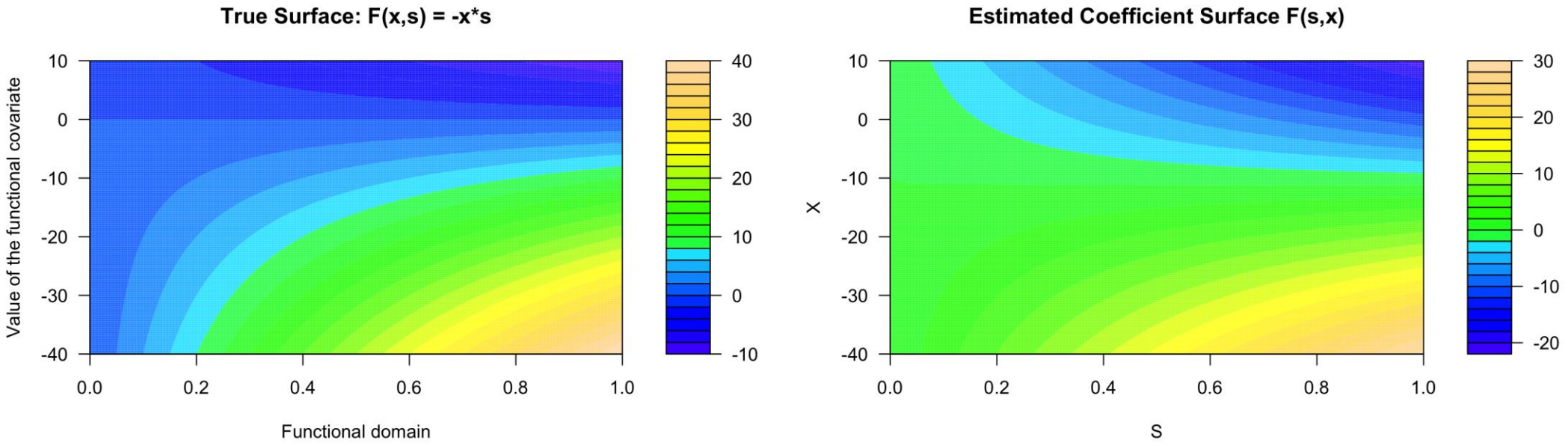
b	beta_type	family	n	nS	mise_surv_norm	mise_surv_cox	mise_surv_faft
0.5	simple	lognormal	500	100	0.000	0.040	0.019
0.5	simple	loglogistic	500	100	0.004	0.033	0.010
0.5	simple	cox.ph	500	100	0.038	0.038	0.173

Addictive functional AFT model

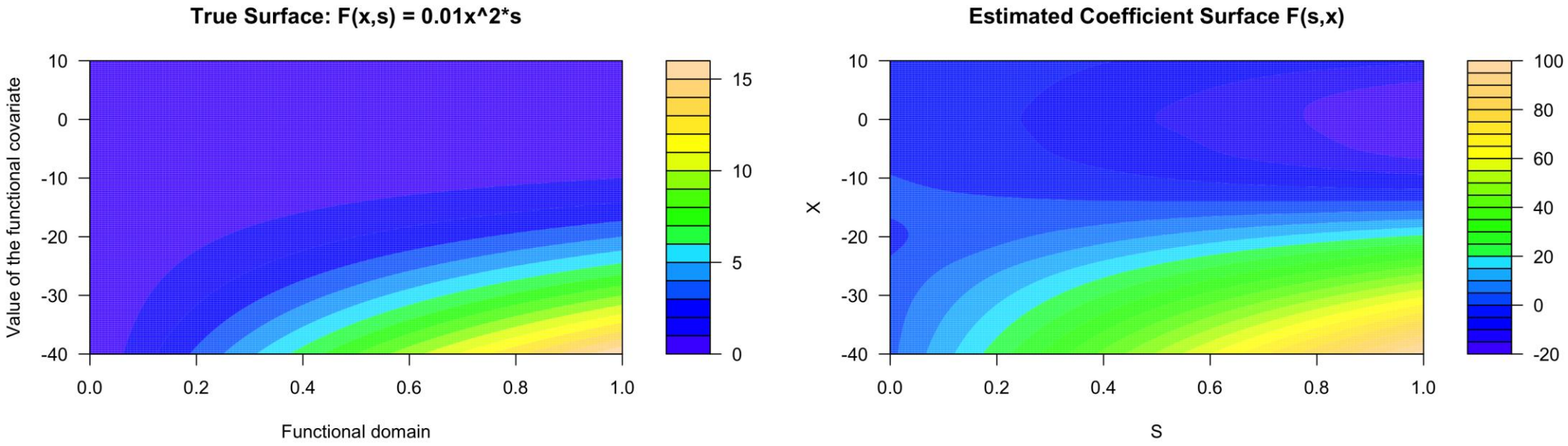




Addictive functional AFT model



Addictive functional AFT model



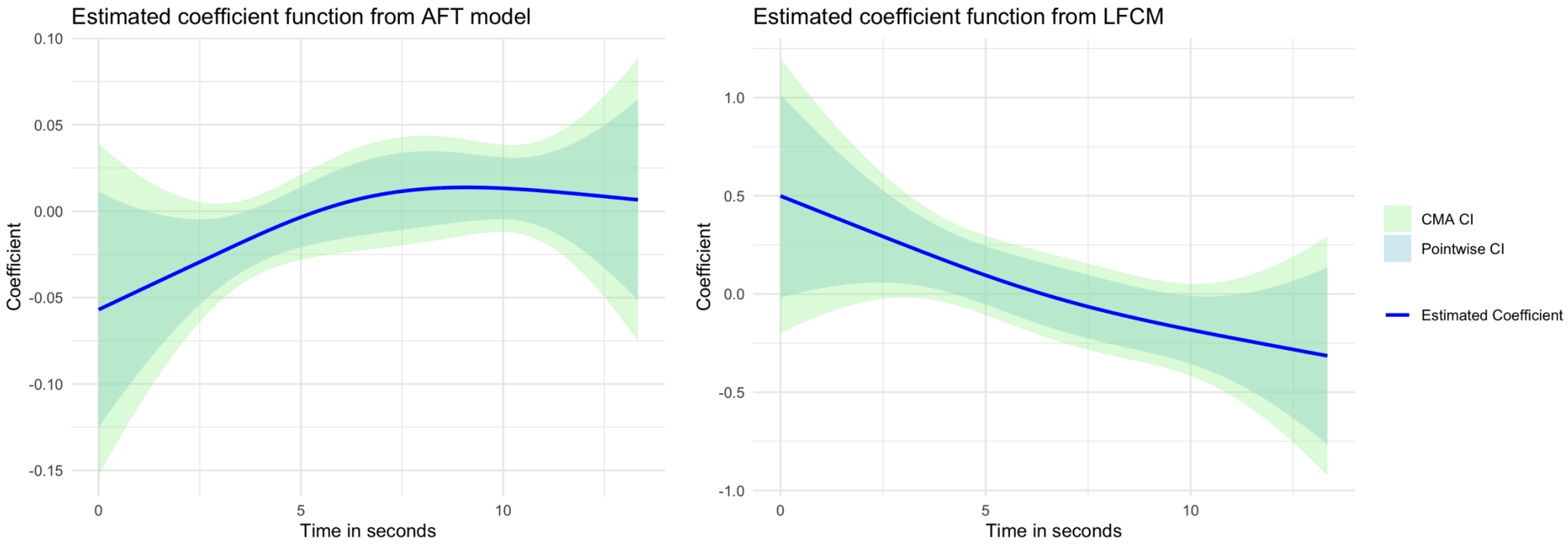
Real data analysis

- 84 subjects, 401 time frames
- Fitted with functional AFT (cnorm) and LFCM

```
Family: cnorm(0.102)
Link function: identity

Formula:
logY ~ 1 + s(S, by = X_L, bs = "ps", k = 30)

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  4.12359    0.04103   100.5   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
           edf Ref.df Chi.sq p-value
s(S):X_L 2.569   2.91   6.35  0.0745 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0311   Deviance explained = 13.6%
-REML = -62.995  Scale est. = 1         n = 53
```

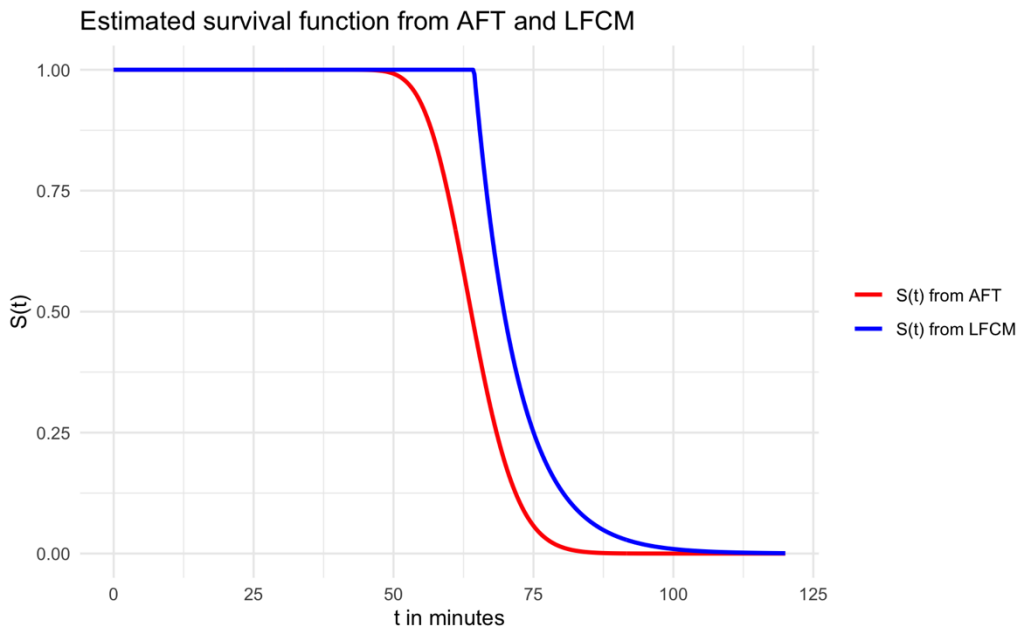
```
Family: Cox PH
Link function: identity

Formula:
Y ~ s(S, by = X_L, bs = "ps", k = 30)

Approximate significance of smooth terms:
           edf Ref.df Chi.sq p-value
s(S):X_L 2.186  2.345  6.257  0.0447 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Deviance explained = 6.99%
-REML =   90.2  Scale est. = 1         n = 53
```

Estimate coefficient functions



Estimated survival functions

- A subject from the user group:



- A subject from the non-user group: