concordance=TRUE

```
## Load libraries
library(splines)
library(MASS)
library(qvalue)

##source functions
source("../functions.R")
```

1 Normally-distributed test statistics

```
alts <- c("alt_z_large","alt_t_large")

alt <- alts[1]

print("I")

## [1] "I"

load(paste(alt,"simResults_1.RData",sep="/"))
load(paste(alt,"simResults_pi0x_thresh_1.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_emp_1.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_1.RData",sep="/"))

pi0StoreyMean <- mean(apply(pValuesSims, 1, function(p){qvalue(p)$pi0}))

plotMeanPi0(pi0, pi0MeansVars, pi0hatScottMean, pi0StoreyMean, pi0StoreyMean, tme=tme, main=
legend("topright", inset=c(-0.45,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

##############################################################################

print("II")
```

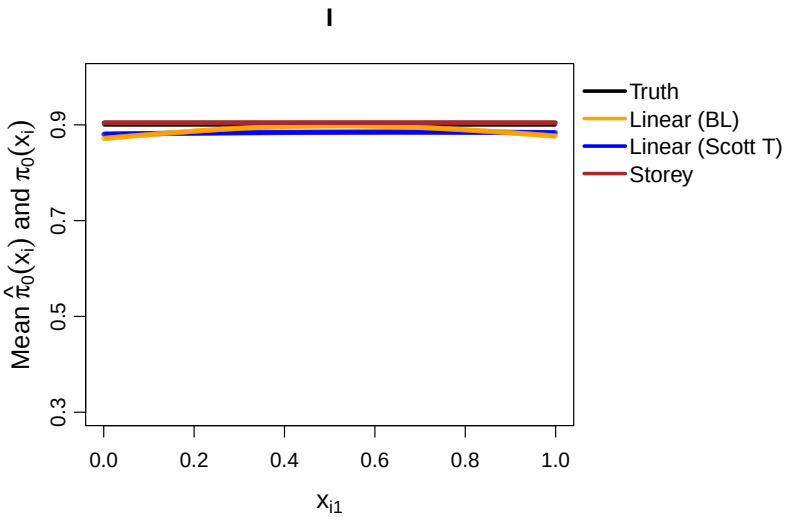
```
## [1] "II"

load(paste(alt,"simResults_2.RData",sep="/"))
load(paste(alt,"simResults_pi0x_thresh_2.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_emp_2.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_2.RData",sep="/"))

pi0StoreyMean <- mean(apply(pValuesSims, 1, function(p){qvalue(p)$pi0}))

plotMeanPi0(pi0, pi0MeansVars, pi0hatScottMean, pi0StoreyMean, pi0StoreyMean, tme=tme, main=
legend("topright", inset=c(-0.45,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

plotMeanPi0(pi0, pi0Spl.MeansVars, pi0hatSpl.ScottMean, pi0StoreyMean, tme=tme, main="II")
legend("topright", inset=c(-0.7,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

################################################################################

print("III")

## [1] "III"

load(paste(alt,"simResults_3.RData",sep="/"))
load(paste(alt,"simResults_pi0x_thresh_3.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_emp_3.RData",sep="/"))
```

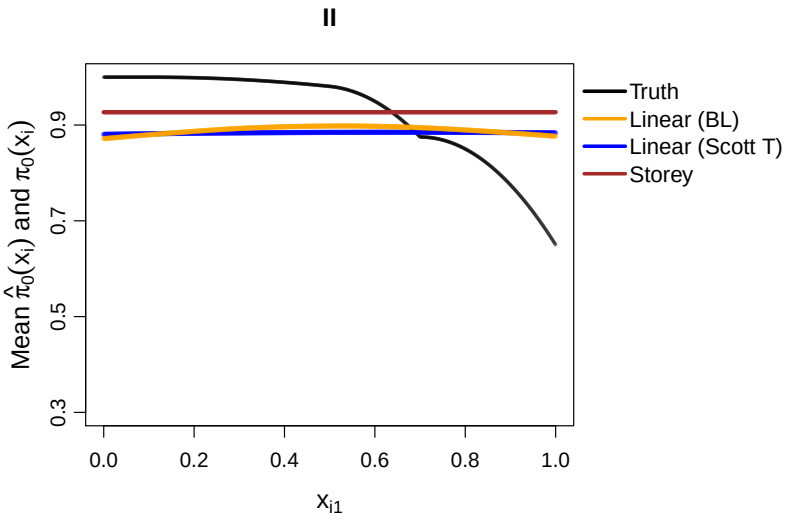
```r
load(paste(alt,"simResults_pi0x_Scott_3.RData",sep="/"))

pi0StoreyMean <- mean(apply(pValuesSims, 1, function(p){qvalue(p)$pi0}))

plotMeanPi0(pi0, pi0Lin.MeansVars, pi0hatLin.ScottMean, pi0StoreyMean, tme=tme, main="III")
legend("topright", inset=c(-0.45,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

plotMeanPi0(pi0, pi0Spl.MeansVars, pi0hatSpl.ScottMean, pi0StoreyMean, tme=tme, main="III")
legend("topright", inset=c(-0.7,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

################################################################################

print("IV")
```

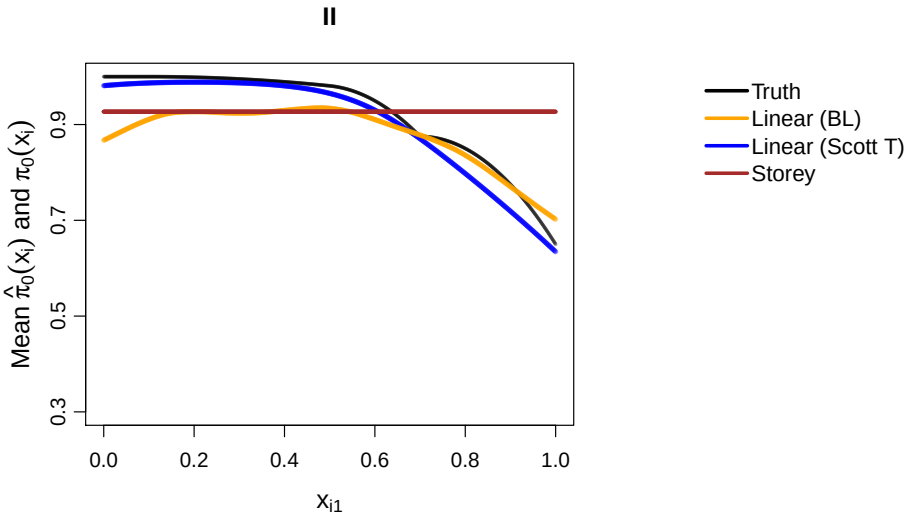
```
## [1] "IV"
```

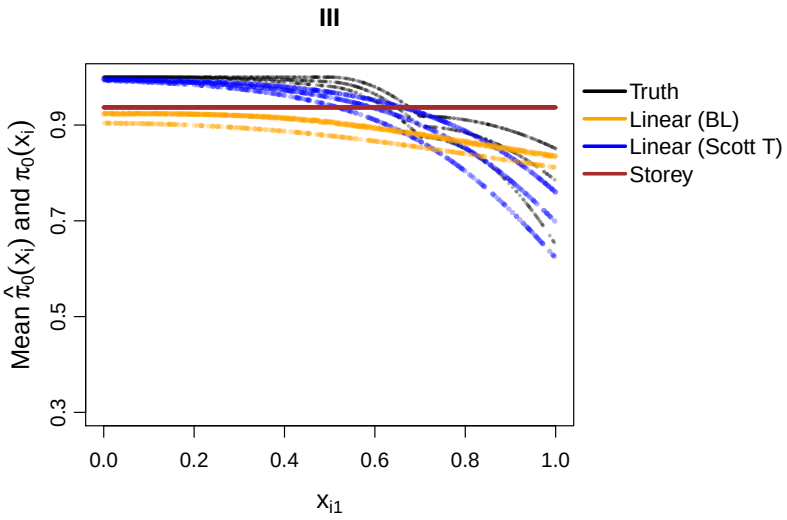
```r
load(paste(alt,"simResults_4.RData",sep="/"))
load(paste(alt,"simResults_pi0x_thresh_4.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_emp_4.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_4.RData",sep="/"))

pi0StoreyMean <- mean(apply(pValuesSims, 1, function(p){qvalue(p)$pi0}))

plotMeanPi0(pi0, pi0Lin.MeansVars, pi0hatLin.ScottMean, pi0StoreyMean, tme=tme, main="IV")
```

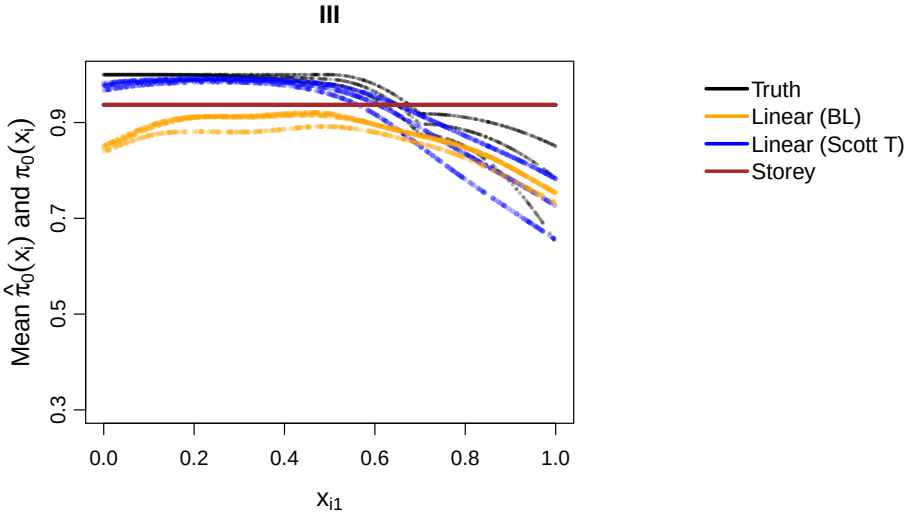
```
legend("topright", inset=c(-0.45,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

plotMeanPi0(pi0, pi0Spl.MeansVars, pi0hatSpl.ScottMean, pi0StoreyMean, tme=tme, main="IV")
legend("topright", inset=c(-0.7,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)
```

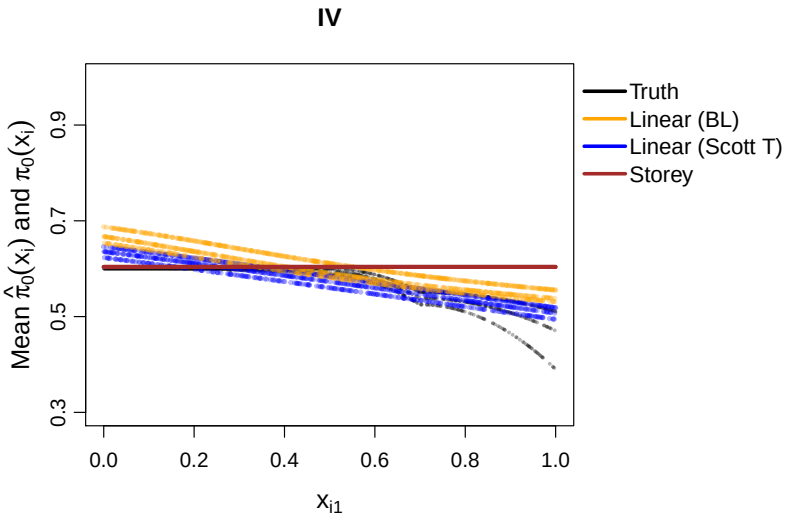


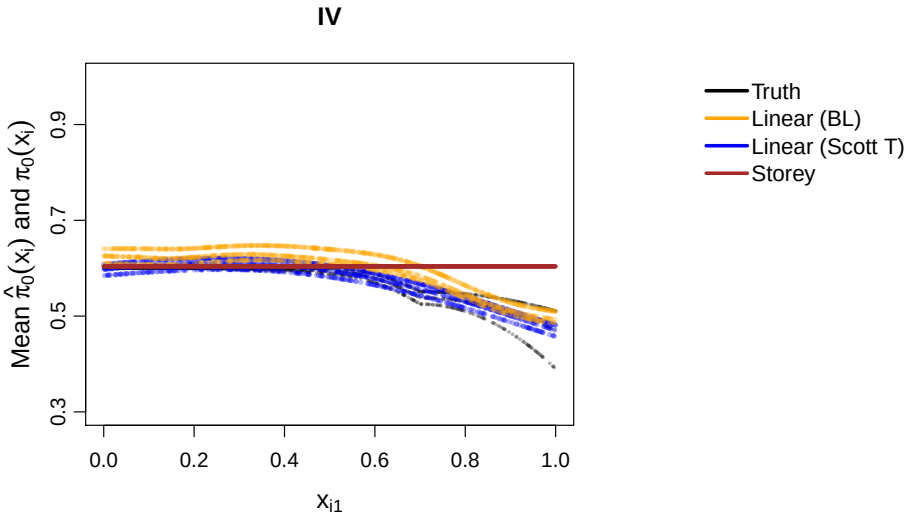

II
Mean $\hat{\pi}_0(x_i)$ and $\pi_0(x_i)$
0.3
0.5
0.7
0.9
0.0
0.2
0.4
0.6
0.8
1.0
x_{i1}
Truth
Linear (BL)
Linear (Scott T)
Storey


II
Mean $\hat{\pi}_0(x_i)$ and $\pi_0(x_i)$
0.3
0.5
0.7
0.9
0.0
0.2
0.4
0.6
0.8
1.0
x_{i1}
Truth
Linear (BL)
Linear (Scott T)
Storey


III
Mean $\hat{\pi}_0(x_i)$ and $\pi_0(x_i)$
0.3
0.5
0.7
0.9
0.0
0.2
0.4
0.6
0.8
1.0
x_{i1}
Truth
Linear (BL)
Linear (Scott T)
Storey


III
Mean $\hat{\pi}_0(x_i)$ and $\pi_0(x_i)$
0.3
0.5
0.7
0.9
0.0
0.2
0.4
0.6
0.8
1.0
x_{i1}
Truth
Linear (BL)
Linear (Scott T)
Storey





2 T-distributed test statistics

```
alt <- alts[2]

print("I")

## [1] "I"
```

```r
load(paste(alt,"simResults_1.RData",sep="/"))
load(paste(alt,"simResults_pi0x_thresh_1.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_emp_1.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_1.RData",sep="/"))

pi0StoreyMean <- mean(apply(pValuesSims, 1, function(p){qvalue(p)$pi0}))

plotMeanPi0(pi0, pi0MeansVars, pi0hatScottMean, pi0StoreyMean, tme=tme, main="I")
legend("topright", inset=c(-0.45,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

################################################################################

print("II")
```

```
## [1] "II"
```

```r
load(paste(alt,"simResults_2.RData",sep="/"))
load(paste(alt,"simResults_pi0x_thresh_2.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_emp_2.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_2.RData",sep="/"))

pi0StoreyMean <- mean(apply(pValuesSims, 1, function(p){qvalue(p)$pi0}))

plotMeanPi0(pi0, pi0Lin.MeansVars, pi0hatLin.ScottMean, pi0StoreyMean, tme=tme, main="II")
legend("topright", inset=c(-0.45,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
```

```
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

plotMeanPi0(pi0, pi0Spl.MeansVars, pi0hatSpl.ScottMean, pi0StoreyMean, tme=tme, main="II")
legend("topright", inset=c(-0.7,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

################################################################################

print("III")
```

```
## [1] "III"
```

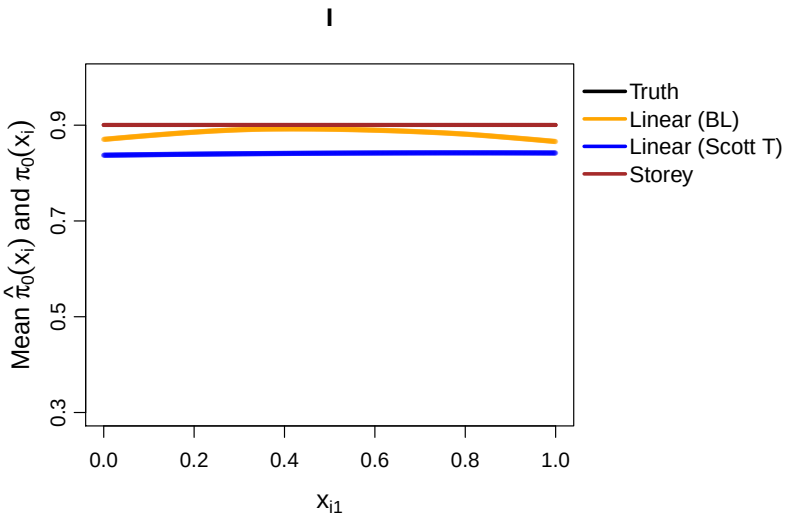
```
load(paste(alt,"simResults_3.RData",sep="/"))
load(paste(alt,"simResults_pi0x_thresh_3.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_emp_3.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_3.RData",sep="/"))

pi0StoreyMean <- mean(apply(pValuesSims, 1, function(p){qvalue(p)$pi0}))

plotMeanPi0(pi0, pi0Lin.MeansVars, pi0hatLin.ScottMean, pi0StoreyMean, tme=tme, main="III")
legend("topright", inset=c(-0.45,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

plotMeanPi0(pi0, pi0Spl.MeansVars, pi0hatSpl.ScottMean, pi0StoreyMean, tme=tme, main="III")
legend("topright", inset=c(-0.7,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
```

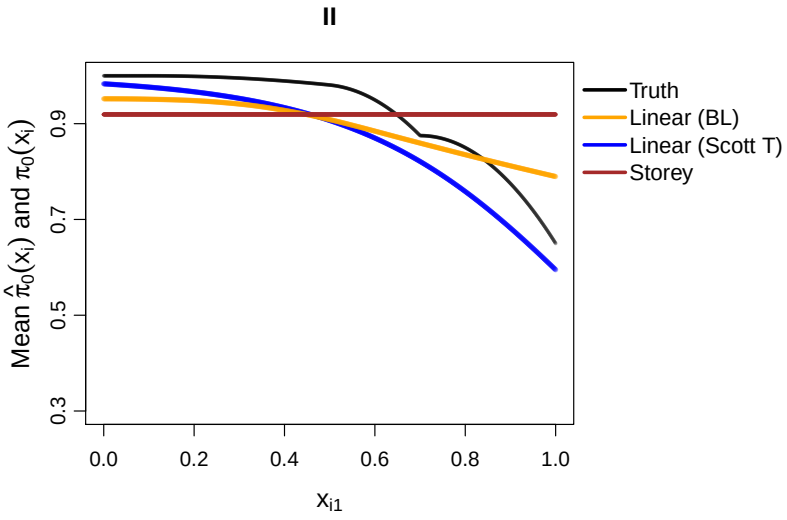
```
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

##############################################################################

print("IV")
```

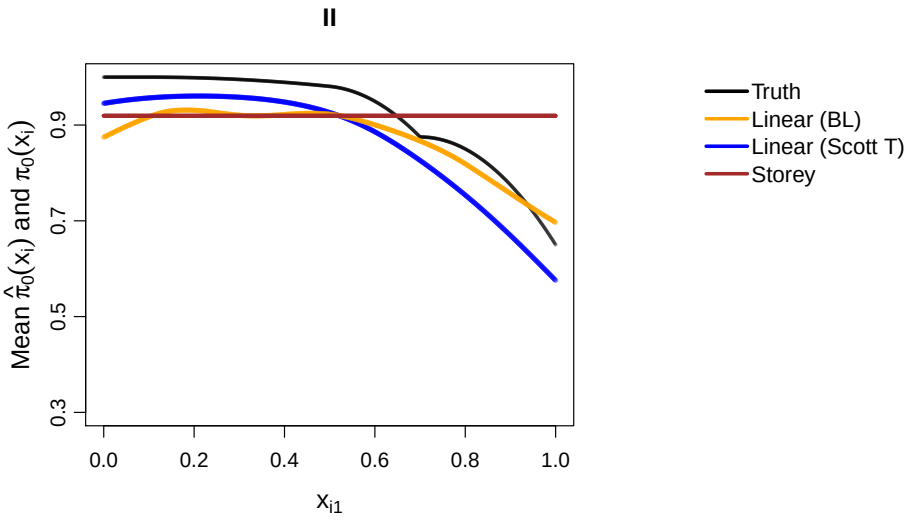
```
## [1] "IV"
```

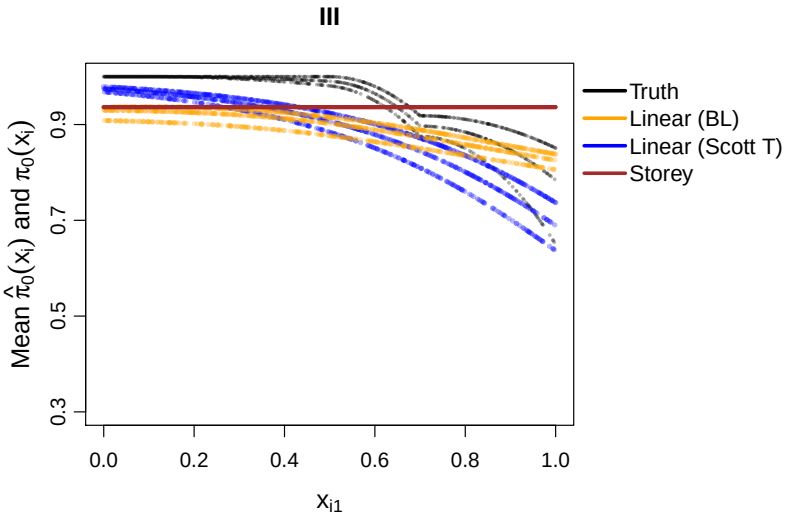
```
load(paste(alt,"simResults_4.RData",sep="/"))
load(paste(alt,"simResults_pi0x_thresh_4.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_emp_4.RData",sep="/"))
load(paste(alt,"simResults_pi0x_Scott_4.RData",sep="/"))

pi0StoreyMean <- mean(apply(pValuesSims, 1, function(p){qvalue(p)$pi0}))

plotMeanPi0(pi0, pi0Lin.MeansVars, pi0hatLin.ScottMean, pi0StoreyMean, tme=tme, main="IV")
legend("topright", inset=c(-0.45,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
             "blue",
             "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)

plotMeanPi0(pi0, pi0Spl.MeansVars, pi0hatSpl.ScottMean, pi0StoreyMean, tme=tme, main="IV")
legend("topright", inset=c(-0.7,0),##x=-0.2, y=0.45,##"bottomright", ##x=-100, y=0.3,
       legend=c("Truth",
                "Linear (BL)",
                "Linear (Scott T)",
                "Storey"),
       col=c("black",
             "orange",
```

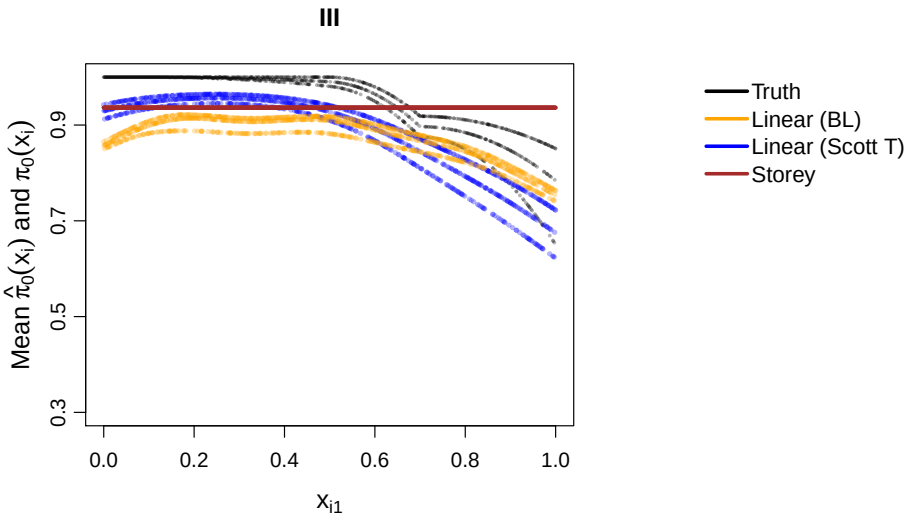
```
            "blue",
            "brown"),
       bty="n",
       lwd=c(3,3,3,3), lty=c(1,1,1,1),
       cex=1.2, x.intersp=0.2, y.intersp=1.0)
```

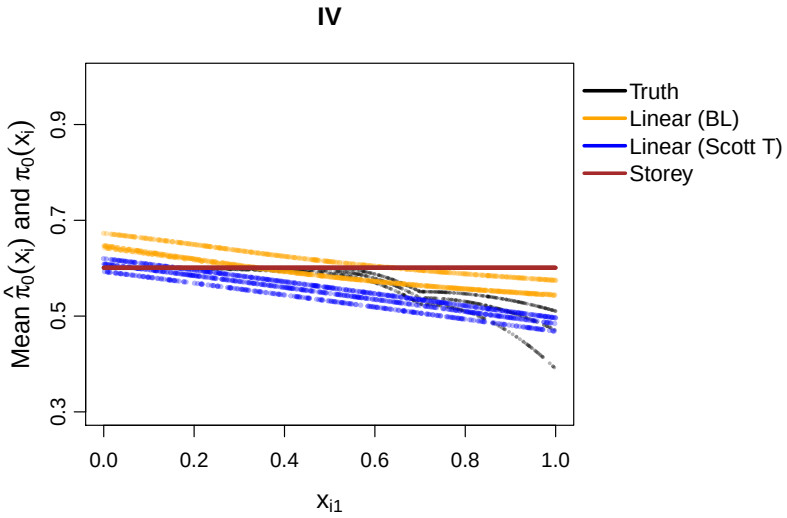


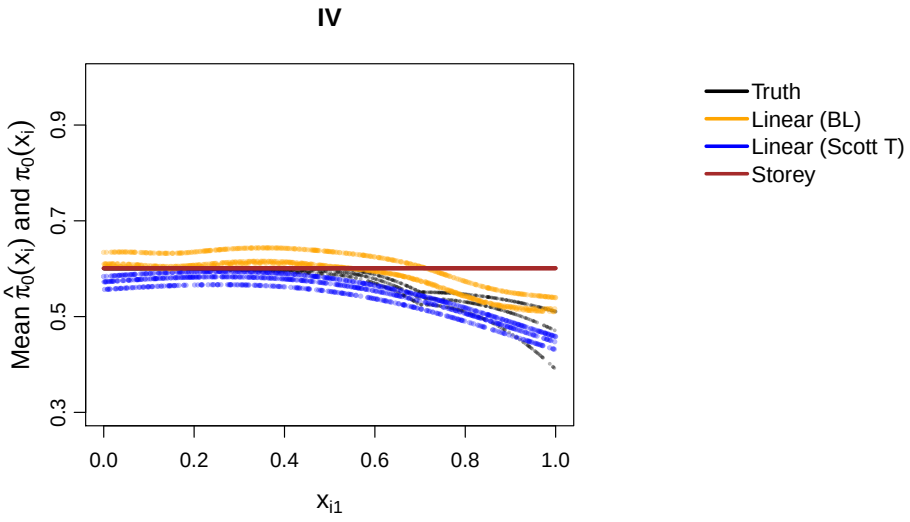



II
Mean $\hat{\pi}_0(x_i)$ and $\pi_0(x_i)$
0.3
0.5
0.7
0.9
0.0
0.2
0.4
0.6
0.8
1.0
x_{i1}
Truth
Linear (BL)
Linear (Scott T)
Storey


III
Mean $\hat{\pi}_0(x_i)$ and $\pi_0(x_i)$
0.3
0.5
0.7
0.9
0.0
0.2
0.4
0.6
0.8
1.0
x_{i1}
Truth
Linear (BL)
Linear (Scott T)
Storey


III
Mean $\hat{\pi}_0(x_i)$ and $\pi_0(x_i)$
0.3
0.5
0.7
0.9
0.0
0.2
0.4
0.6
0.8
1.0
x_{i1}
Truth
Linear (BL)
Linear (Scott T)
Storey


IV
Mean $\hat{\pi}_0(x_i)$ and $\pi_0(x_i)$
0.3
0.5
0.7
0.9
0.0
0.2
0.4
0.6
0.8
1.0
x_{i1}
Truth
Linear (BL)
Linear (Scott T)
Storey



Session info:

```
devtools::session_info()

## Session info -------------------------------------------------

##  setting  value
##  version  R version 3.4.4 (2018-03-15)
##  system   i386, mingw32
##  ui       RTerm
##  language (EN)
##  collate  English_United States.1252
##  tz       America/New_York
##  date     2018-06-08

## Packages -----------------------------------------------------

##  package    * version    date
##  base       * 3.4.4      2018-03-15
##  colorspace   1.3-2      2016-12-14
##  compiler     3.4.4      2018-03-15
##  datasets   * 3.4.4      2018-03-15
##  devtools     1.13.5     2018-02-18
##  digest       0.6.15     2018-01-28
##  evaluate     0.10.1     2017-06-24
##  ggplot2      2.2.1.9000 2018-05-08
##  graphics   * 3.4.4      2018-03-15
##  grDevices  * 3.4.4      2018-03-15
##  grid         3.4.4      2018-03-15
```

```
##  gtable       0.2.0      2016-02-26
##  highr        0.6        2016-05-09
##  knitr      * 1.20       2018-02-20
##  lazyeval     0.2.1      2017-10-29
##  magrittr     1.5        2014-11-22
##  MASS       * 7.3-49     2018-02-23
##  memoise      1.1.0      2017-04-21
##  methods    * 3.4.4      2018-03-15
##  munsell      0.4.3      2016-02-13
##  pillar       1.2.2      2018-04-26
##  plyr         1.8.4      2016-06-08
##  qvalue     * 2.10.0     2017-10-31
##  Rcpp         0.12.16    2018-03-13
##  reshape2     1.4.3      2017-12-11
##  rlang        0.2.0.9001 2018-05-08
##  scales       0.5.0.9000 2018-05-08
##  splines    * 3.4.4      2018-03-15
##  stats      * 3.4.4      2018-03-15
##  stringi      1.1.7      2018-03-12
##  stringr      1.3.0      2018-02-19
##  tibble       1.4.2      2018-01-22
##  tools        3.4.4      2018-03-15
##  utils      * 3.4.4      2018-03-15
##  withr        2.1.2      2018-03-15
##  source
##  local
##  CRAN (R 3.4.1)
##  local
##  local
##  CRAN (R 3.4.3)
##  CRAN (R 3.4.3)
##  CRAN (R 3.4.1)
##  Github (tidyverse/ggplot2@f59ed7c)
##  local
##  local
##  local
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.4)
##  CRAN (R 3.4.2)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.4)
##  CRAN (R 3.4.1)
##  local
##  CRAN (R 3.4.1)
```

```
##  CRAN (R 3.4.4)
##  CRAN (R 3.4.1)
##  Bioconductor
##  CRAN (R 3.4.4)
##  CRAN (R 3.4.3)
##  Github (r-lib/rlang@5ba52da)
##  Github (hadley/scales@d767915)
##  local
##  local
##  CRAN (R 3.4.4)
##  CRAN (R 3.4.4)
##  CRAN (R 3.4.3)
##  local
##  local
##  CRAN (R 3.4.4)
```