Fit model by fixing factor variance, using MLM.

```
library(lavaan)
```

```
## This is lavaan 0.6-1.1132
```

```
## lavaan is BETA software! Please report any bugs.
```

```
HS.model <- ' visual  =~ x1 + lam2*x2 + x3
              textual =~ x4 + x5 + x6
              speed   =~ x7 + x8 + x9 '

fit <- lavaan(HS.model, data=HolzingerSwineford1939,
              auto.var=TRUE, auto.fix.first=FALSE, std.lv=TRUE,
              auto.cov.lv.x=TRUE, estimator="MLM",
              meanstructure=TRUE, int.ov.free=TRUE)
#summary(fit, fit.measures=TRUE)
```

Fit model with constraint. Not that I would ever really constrain the second loading to 1.1, but this does appear to break the difference test.

```
HS.model <- ' visual  =~ x1 + lam2*x2 + x3
              textual =~ x4 + x5 + x6
              speed   =~ x7 + x8 + x9 '
const<-"lam2 == 1.1"
fit.const <- lavaan(HS.model, data=HolzingerSwineford1939,constraints=const,
              auto.var=TRUE, auto.fix.first=FALSE, std.lv=TRUE,
              auto.cov.lv.x=TRUE, estimator="MLM",
              meanstructure=TRUE, int.ov.free=TRUE)
```

```
## Warning in lav_options_set(opt): lavaan WARNING: information will be set to
## "expected" for estimator = "MLM"
```

```
#summary(fit.const, fit.measures=TRUE)
```

Compute robust difference tests. Note how the so-called strictly positive differen test (Satorra & Bentler, 2010) actually goes negative...

```
lavTestLRT(fit,fit.const,method="satorra.bentler.2001") # NA, but with warning about neg scaling factor
```

```
## Warning in lav_test_diff_SatorraBentler2001(mods[[m]], mods[[m + 1]]):
## lavaan WARNING: scaling factor is negative
```

```
## Scaled Chi Square Difference Test (method = "satorra.bentler.2001")
##
##           Df    AIC    BIC   Chisq Chisq diff Df diff Pr(>Chisq)
## fit       24 7535.5 7646.7  85.305
## fit.const 25 7581.3 7688.8 133.105                  1
```

```
lavTestLRT(fit,fit.const,method="satorra.bentler.2010") # -621.52
```

```
## Scaled Chi Square Difference Test (method = "satorra.bentler.2010")
##
##           Df    AIC    BIC   Chisq Chisq diff Df diff Pr(>Chisq)
## fit       24 7535.5 7646.7  85.305
## fit.const 25 7581.3 7688.8 133.105    -621.52       1          1
```