

# Homework 3

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## Question 1

```
## Add a nominal covariate into the model (sex)
```

```
#Predicting intercept
```

```
model1a <- lmer(PPeerScale ~ age + sex_01 + (age | ID), data=data_long)
tidy(model1a)
```

##		term	estimate	std.error	statistic	group
## 1		(Intercept)	60.0226065	0.80293062	74.754412	fixed
## 2		age	0.1398691	0.07583897	1.844291	fixed
## 3		sex_01	1.1445315	0.81234532	1.408922	fixed
## 4		sd_(Intercept).ID	9.3856236	NA	NA	ID
## 5		sd_age.ID	0.9272482	NA	NA	ID
## 6		cor_(Intercept).age.ID	-0.7219755	NA	NA	ID
## 7		sd_Observation.Residual	5.5121080	NA	NA	Residual

```
#Predicting intercept and slope
```

```
model1b <- lmer(PPeerScale ~ age + sex_01 + age:sex_01 + (age | ID), data=data_long)
tidy(model1b)
```

##		term	estimate	std.error	statistic	group
## 1		(Intercept)	60.15626064	0.9734250	61.7985547	fixed
## 2		age	0.12212264	0.1052498	1.1603118	fixed
## 3		sex_01	0.86830675	1.3972050	0.6214598	fixed
## 4		age:sex_01	0.03706303	0.1521906	0.2435303	fixed
## 5		sd_(Intercept).ID	9.41102333	NA	NA	ID
## 6		sd_age.ID	0.93139467	NA	NA	ID
## 7		cor_(Intercept).age.ID	-0.72388054	NA	NA	ID
## 8		sd_Observation.Residual	5.51149113	NA	NA	Residual

```
#Predicting intercept and slope, with sex centered
```

```
model1c <- lmer(PPeerScale ~ age + sex_c + age:sex_c + (age | ID), data=data_long)
tidy(model1c)
```

##		term	estimate	std.error	statistic	group
## 1		(Intercept)	60.57622586	0.69830867	86.7470625	fixed
## 2		age	0.14004856	0.07602785	1.8420692	fixed
## 3		sex_c	0.86830540	1.39720619	0.6214583	fixed
## 4		age:sex_c	0.03706321	0.15219071	0.2435313	fixed
## 5		sd_(Intercept).ID	9.41103774	NA	NA	ID
## 6		sd_age.ID	0.93139569	NA	NA	ID
## 7		cor_(Intercept).age.ID	-0.72388126	NA	NA	ID
## 8		sd_Observation.Residual	5.51148999	NA	NA	Residual

```
model1c_t <- lmer(TPeerScale ~ age + sex_c + age:sex_c + (age | ID), data=data_long)
```

Centering the nominal covariate (sex) affected the fixed effect estimate of age. This makes sense, since, with

the introduction of the interaction term in model b, now means that the fixed effect of age is representative of the predicted change in PPeer (x) for every unit change in age (y), when sex = 0. Prior to centering, this then represented the mean change for males (dummy coded as 0), but after centering indicates the average mean change across both genders.

## Question 2

```
## Add a continuous time-invariant covariate into the model (SES=T1Income_to_Need)
```

```
#Predicting intercept
```

```
model2a <- lmer(PPeerScale ~ age + T1Income_to_Need + (age | ID), data=data_long)
tidy(model2a)
```

##		term	estimate	std.error	statistic	group
## 1		(Intercept)	57.9969948	1.02198386	56.749423	fixed
## 2		age	0.1159405	0.08002175	1.448863	fixed
## 3		T1Income_to_Need	1.3132346	0.34943302	3.758187	fixed
## 4		sd_(Intercept).ID	8.8914954	NA	NA	ID
## 5		sd_age.ID	0.9349945	NA	NA	ID
## 6		cor_(Intercept).age.ID	-0.7205910	NA	NA	ID
## 7		sd_Observation.Residual	5.5875156	NA	NA	Residual

```
#Predicting intercept and slope
```

```
model2b <- lmer(PPeerScale ~ age + T1Income_to_Need + age:T1Income_to_Need + (age | ID), data=data_long)
tidy(model2b)
```

##		term	estimate	std.error	statistic	group
## 1		(Intercept)	56.62454864	1.45236144	38.987918	fixed
## 2		age	0.30440457	0.16287574	1.868937	fixed
## 3		T1Income_to_Need	1.97092892	0.60565796	3.254195	fixed
## 4		age:T1Income_to_Need	-0.09058726	0.06819463	-1.328364	fixed
## 5		sd_(Intercept).ID	8.87935104	NA	NA	ID
## 6		sd_age.ID	0.93424638	NA	NA	ID
## 7		cor_(Intercept).age.ID	-0.72009574	NA	NA	ID
## 8		sd_Observation.Residual	5.58681457	NA	NA	Residual

```
#Predicting intercept and slope, with SES centered
```

```
model2c <- lmer(PPeerScale ~ age + T1Income_to_Need_c + age:T1Income_to_Need_c + (age | ID), data=data_long)
tidy(model2c)
```

##		term	estimate	std.error	statistic	group
## 1		(Intercept)	60.69319059	0.70811194	85.711294	fixed
## 2		age	0.11740286	0.07999075	1.467705	fixed
## 3		T1Income_to_Need_c	1.97092901	0.60565808	3.254194	fixed
## 4		age:T1Income_to_Need_c	-0.09058727	0.06819465	-1.328363	fixed
## 5		sd_(Intercept).ID	8.87935358	NA	NA	ID
## 6		sd_age.ID	0.93424691	NA	NA	ID
## 7		cor_(Intercept).age.ID	-0.72009642	NA	NA	ID
## 8		sd_Observation.Residual	5.58681503	NA	NA	Residual

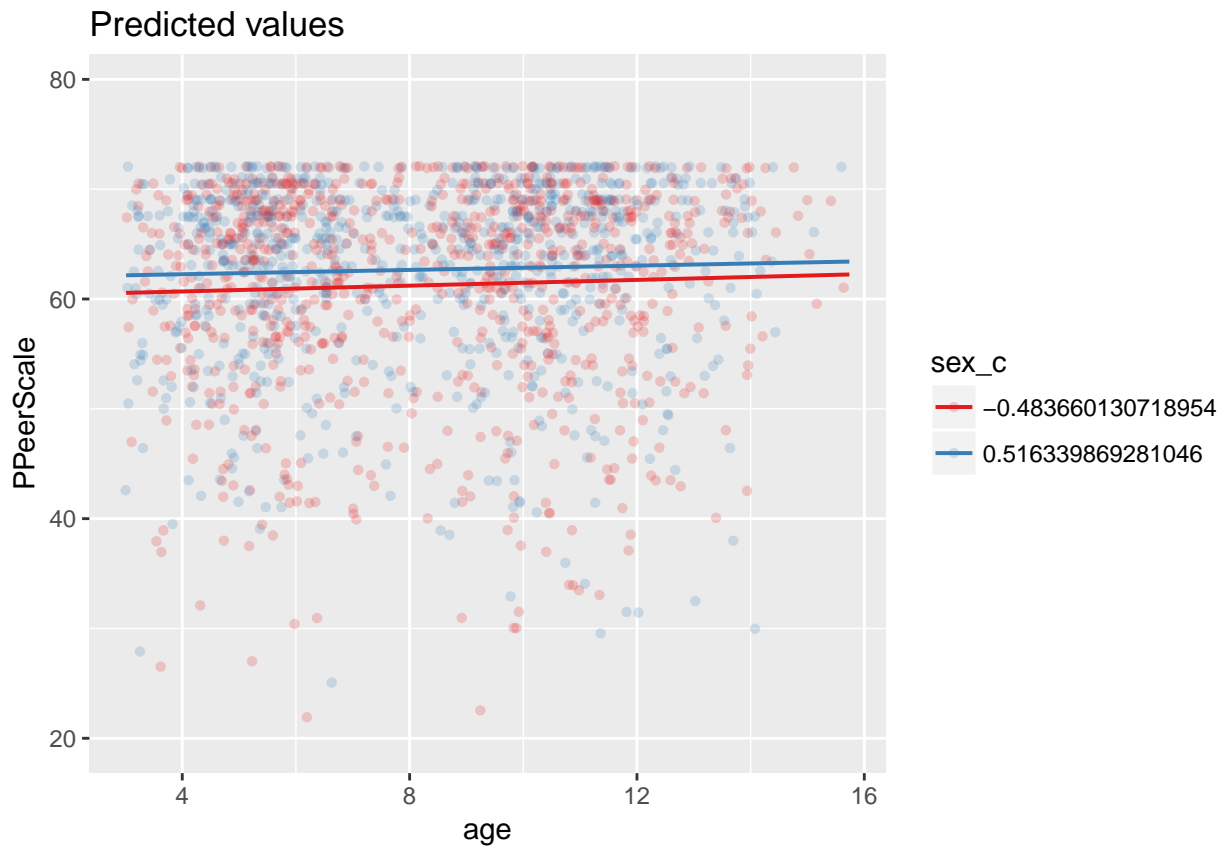
```
model2c_t <- lmer(TPeerScale ~ age + T1Income_to_Need_c + age:T1Income_to_Need_c + (age | ID),
  data=data_long)
```

Centering the covariate affected the Intercept and age fixed effects estimates, since (similar to above), they

go from being interpreted as the average intercept and average change in PPeer with age of the male group to the average intercept and change in PPeer with age of all subjects.

### Question 3

```
sjp.lmer(model1c, type="pred", facet.grid=F,  
  vars = c("age", "sex_c"))
```



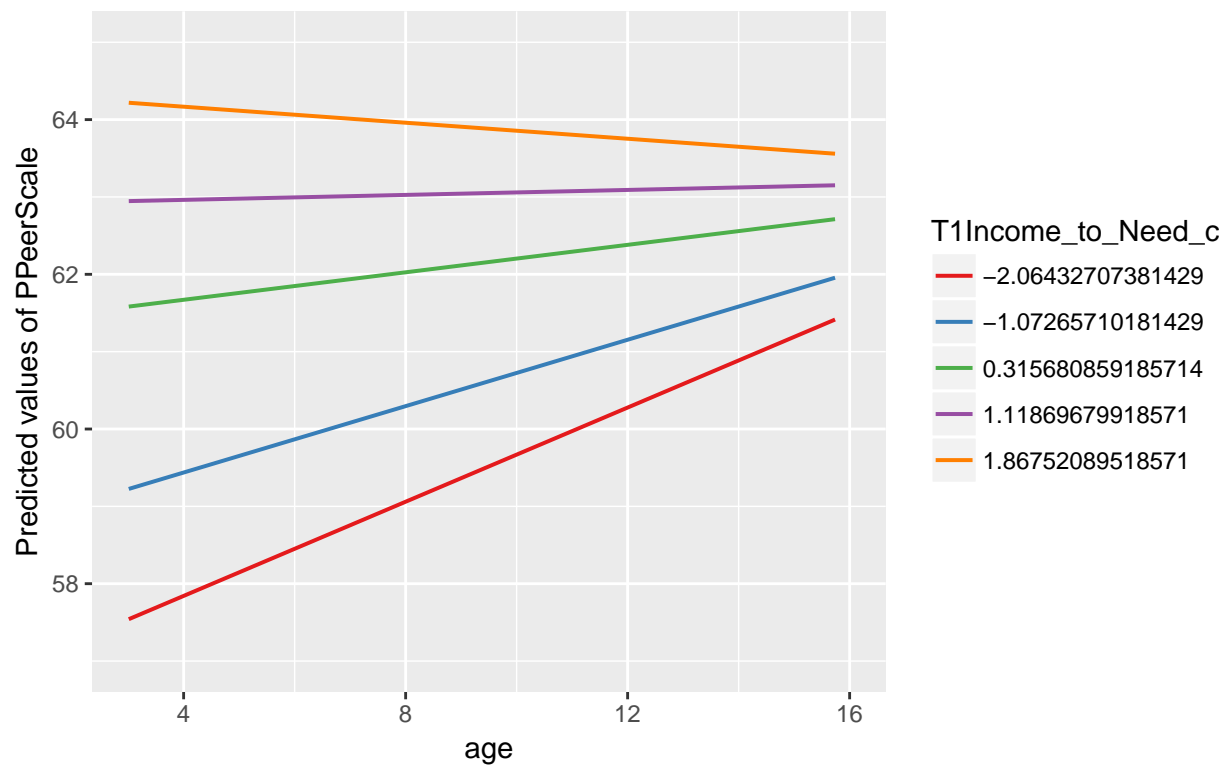
```
sjp.lmer(model1c_t, type="pred", facet.grid=F,  
  vars = c("age", "sex_c"))
```



```
sjp.int(model2c,  
  type = "eff",  
  mdrt.values = "quart",  
  swap.pred=T,  
  p.value=.05)
```

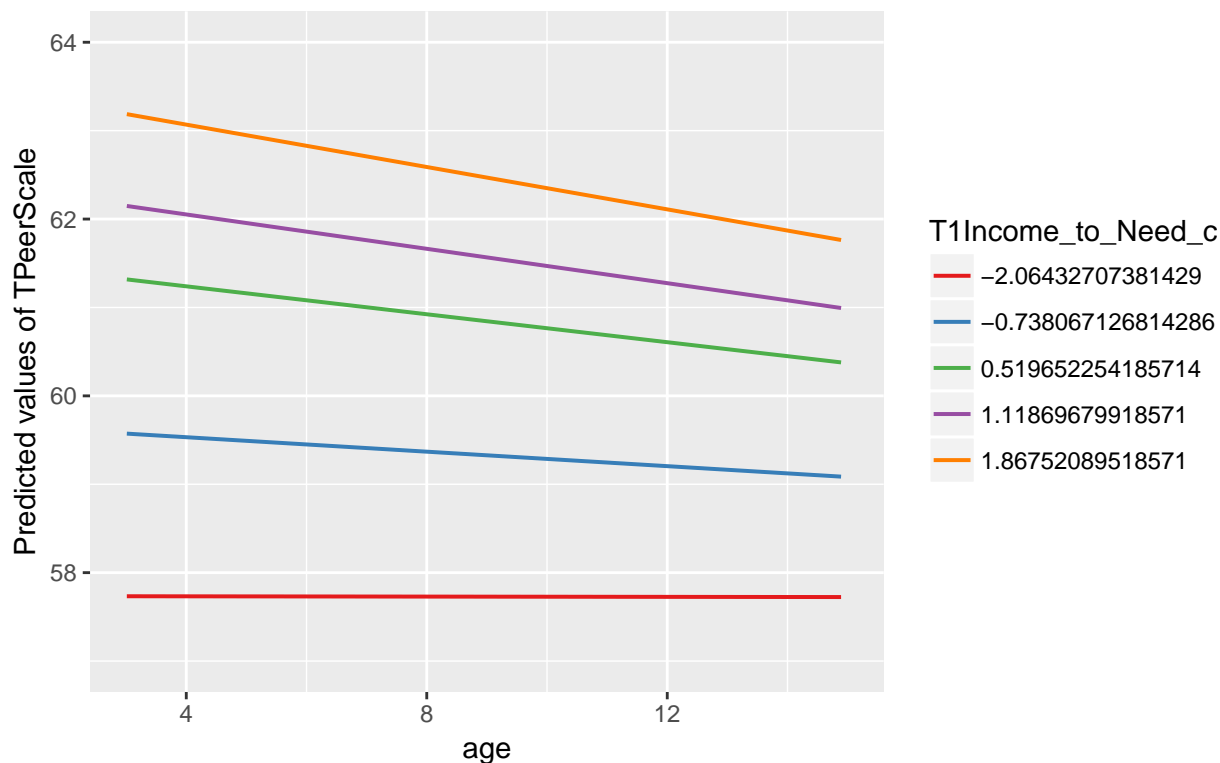
```
## Note: method with signature 'sparseMatrix#ANY' chosen for function 'kronecker',  
## target signature 'dgCMatrix#ngCMatrix'.  
## "ANY#sparseMatrix" would also be valid
```

Interaction effect of T1Income\_to\_Need\_c and age on PPeerScale



```
sjp.int(model2c_t,
  type = "eff",
  mdrt.values = "quart",
  swap.pred=T,
  p.value=.05)
```

### Interaction effect of T1Income\_to\_Need\_c and age on TPeerScale



### Question 4

```
model1c_ci <- confint(model1c, level=.95, oldNames=F, method="boot", nsim=100)
```

```
## Computing bootstrap confidence intervals ...
```

```
model1c_ci[c(1,3,5:8),]
```

```
##                2.5 %    97.5 %
## sd_(Intercept)|ID 8.23561604 10.6522435
## sd_age|ID         0.77344713  1.1148318
## (Intercept)      59.11656052 61.8841314
## age              -0.02172511  0.3063149
## sex_c            -1.97715027  4.9660375
## age:sex_c        -0.33297121  0.3694215
```

```
model2c_ci <- confint(model2c, level=.95, oldNames=F, method="boot", nsim=100)
```

```
##Computing bootstrap confidence intervals ...
```

```
model2c_ci[c(1,3,5:8),]
```

```
##                2.5 %    97.5 %
## sd_(Intercept)|ID 7.47905870 10.18743476
## sd_age|ID         0.75659256  1.09645878
## (Intercept)      59.15845251 62.05091765
## age              -0.05420942  0.31596190
```

```
## T1Income_to_Need_c      0.88654256  3.18565339
## age:T1Income_to_Need_c -0.23996012  0.03358028
```

## Question 5

```
model5 <- lmer(PPeerScale ~ age*T1Income_to_Need_c + age*sex_01 + (age | ID), data=data_long)
model5_t <- lmer(TPeerScale ~ age*T1Income_to_Need_c + age*sex_01 + (age | ID), data=data_long)
```

```
tidy(model5)
```

##		term	estimate	std.error	statistic	group
## 1		(Intercept)	60.27697756	0.99465839	60.6006829	fixed
## 2		age	0.10353002	0.11137647	0.9295502	fixed
## 3		T1Income_to_Need_c	1.97903445	0.60695547	3.2605925	fixed
## 4		sex_01	0.82678254	1.41910153	0.5826099	fixed
## 5		age:T1Income_to_Need_c	-0.09128101	0.06840884	-1.3343451	fixed
## 6		age:sex_01	0.03254273	0.16060463	0.2026263	fixed
## 7		sd_(Intercept).ID	8.90930187	NA	NA	ID
## 8		sd_age.ID	0.93963380	NA	NA	ID
## 9		cor_(Intercept).age.ID	-0.72419531	NA	NA	ID
## 10		sd_Observation.Residual	5.58696375	NA	NA	Residual

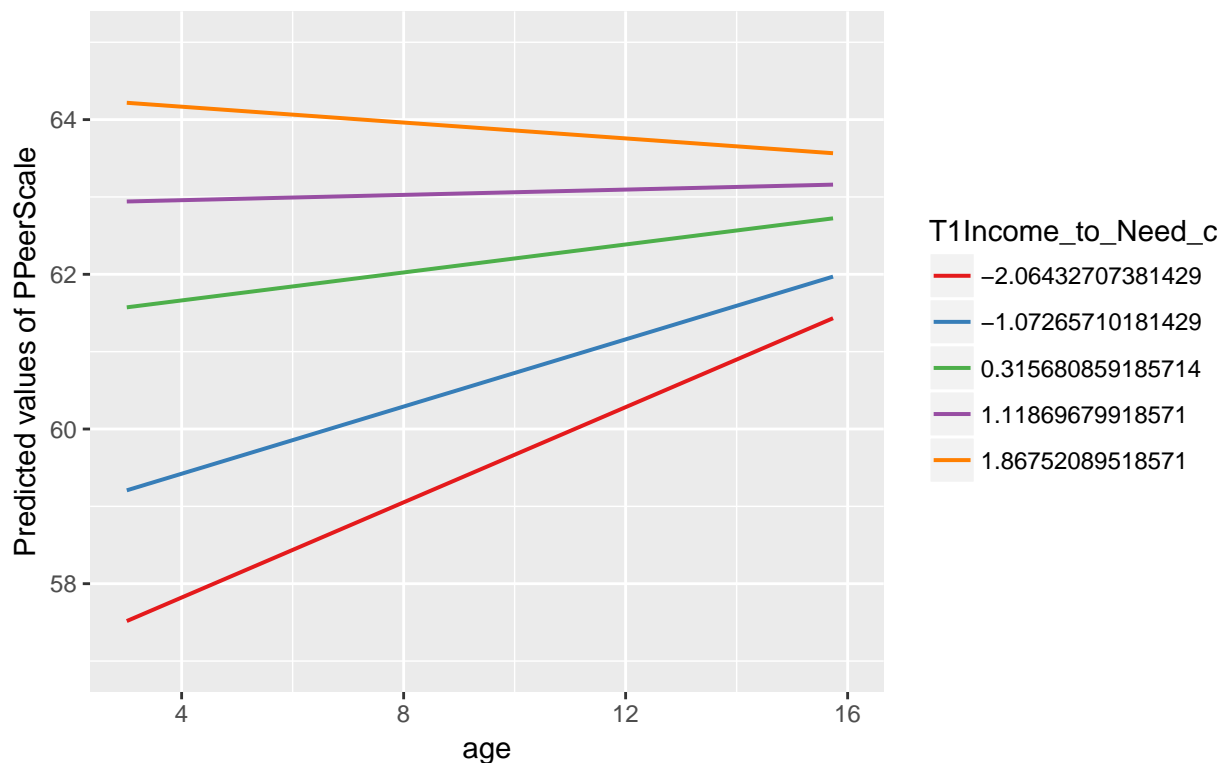
```
tidy(model2c)
```

##		term	estimate	std.error	statistic	group
## 1		(Intercept)	60.69319059	0.70811194	85.711294	fixed
## 2		age	0.11740286	0.07999075	1.467705	fixed
## 3		T1Income_to_Need_c	1.97092901	0.60565808	3.254194	fixed
## 4		age:T1Income_to_Need_c	-0.09058727	0.06819465	-1.328363	fixed
## 5		sd_(Intercept).ID	8.87935358	NA	NA	ID
## 6		sd_age.ID	0.93424691	NA	NA	ID
## 7		cor_(Intercept).age.ID	-0.72009642	NA	NA	ID
## 8		sd_Observation.Residual	5.58681503	NA	NA	Residual

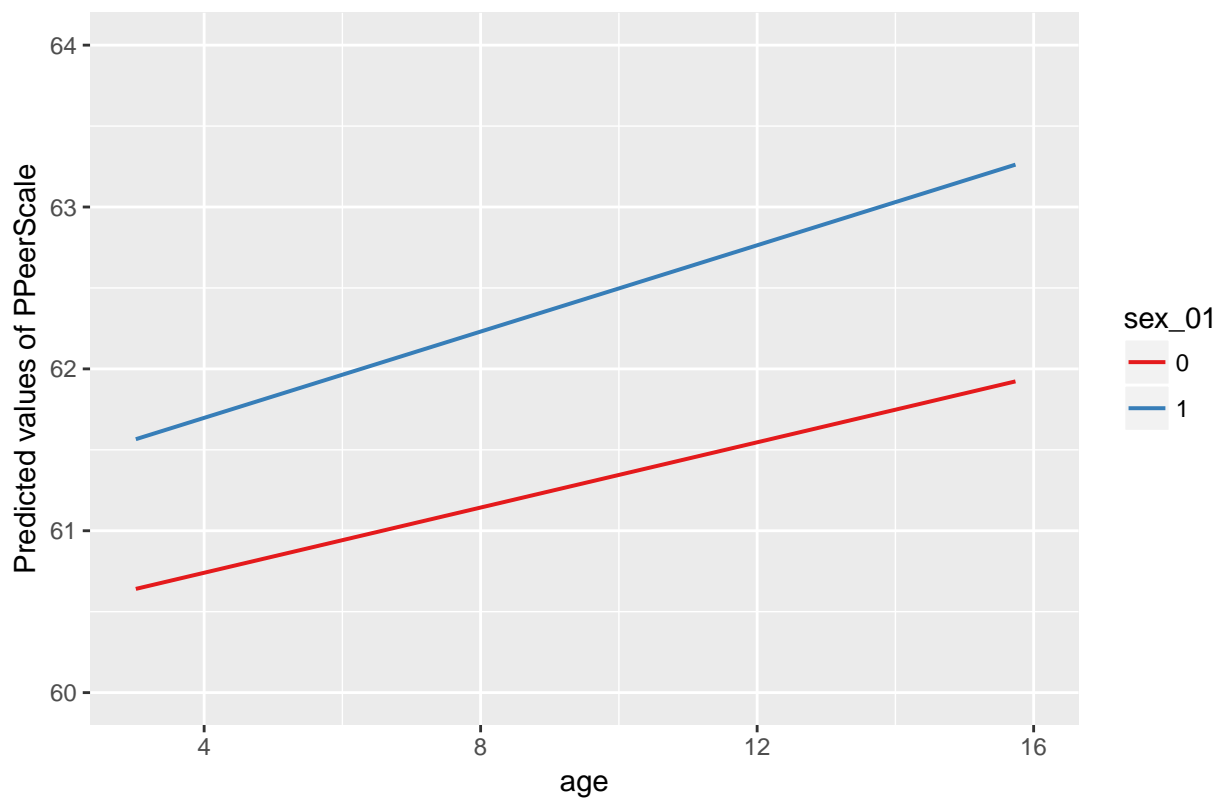
```
sjp.int(model5,
  type = "eff",
  mdrt.values = "quart",
  swap.pred=T,
  p.value=.05)
```

```
## Could not compute quartiles, too small range of moderator variable. Defaulting `mdrt.values` to `min`
```

Interaction effect of T1Income\_to\_Need\_c and age on PPeerScale



Interaction effect of sex\_01 and age on PPeerScale





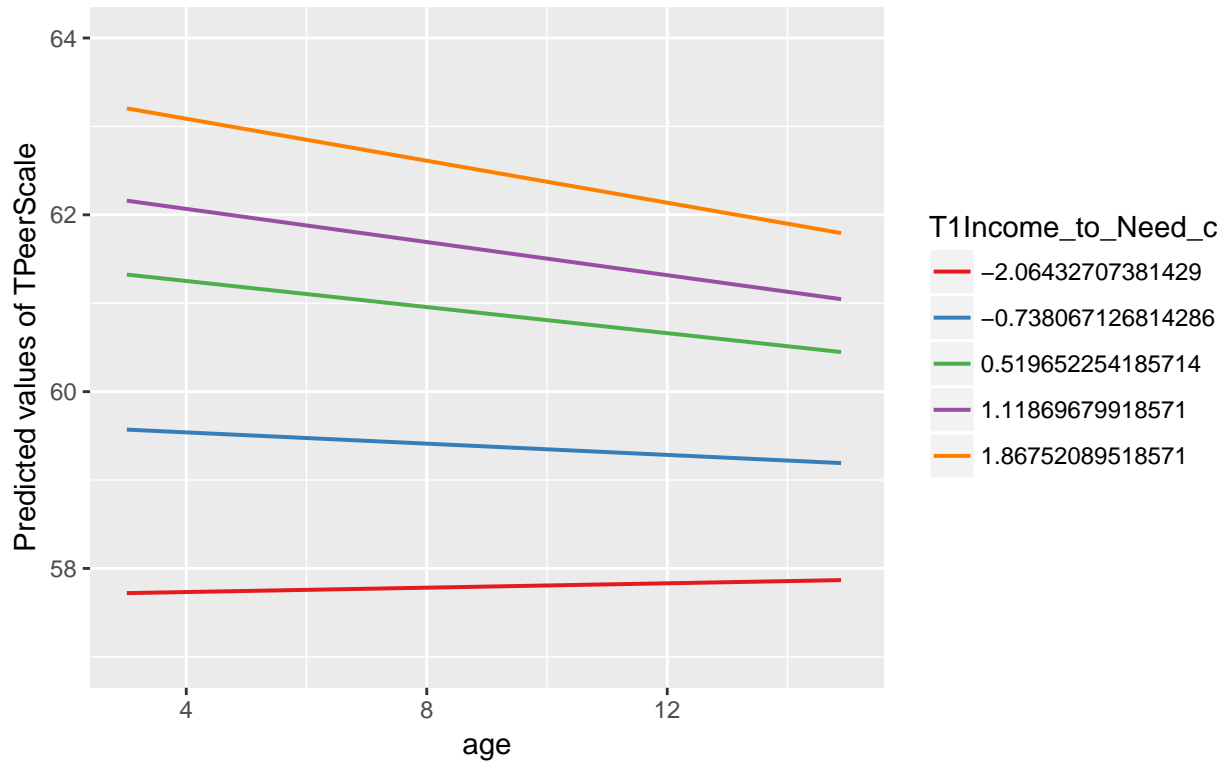
```

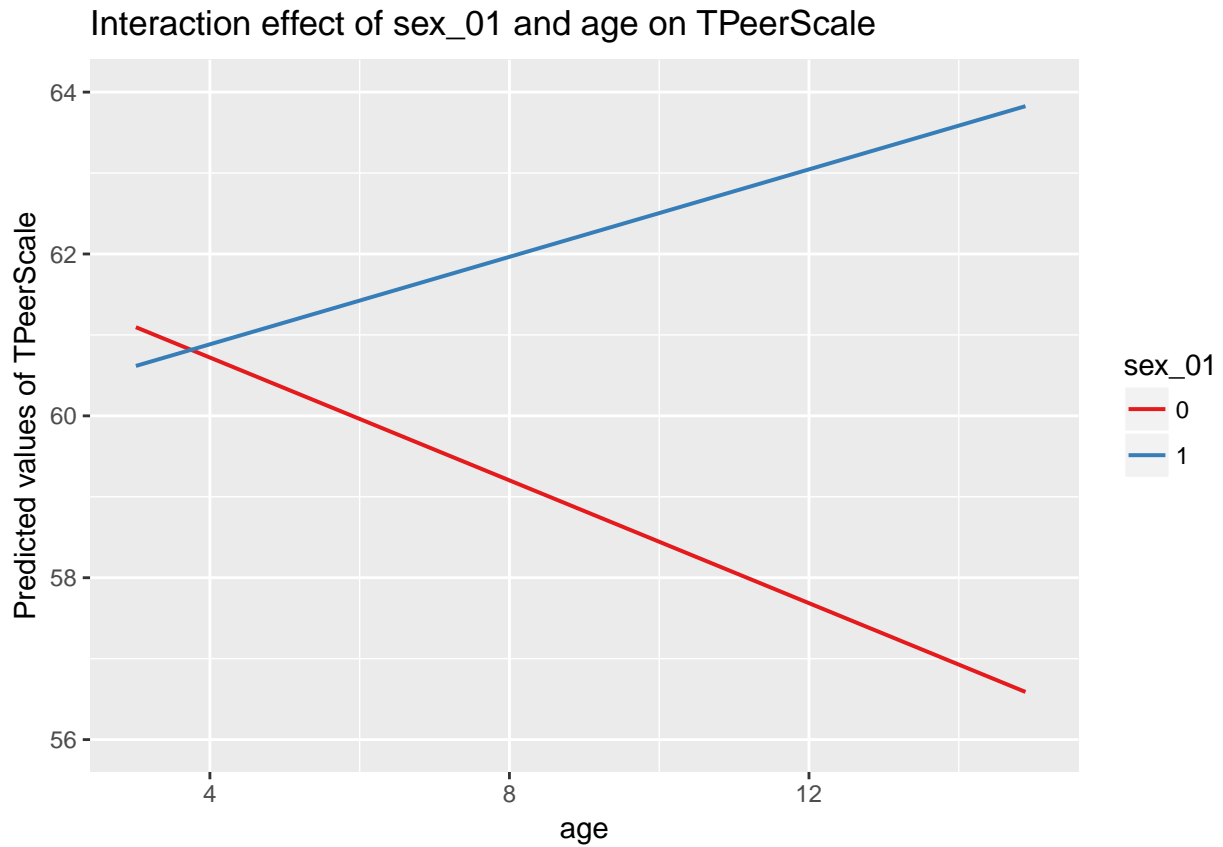
sjp.int(model5_t,
        type = "eff",
        mdrt.values = "quart",
        swap.pred=T,
        p.value=.05)

```

## Could not compute quartiles, too small range of moderator variable. Defaulting `mdrt.values` to `min`

### Interaction effect of T1Income\_to\_Need\_c and age on TPeerScale





The fixed effect of sex now represents the difference between males and females at average levels of SES (females scored 0.8267825 higher than males). The fixed effect of SES represents the slope (SES and PPeer) of the reference group (males in this case). Age and sex interaction indicates difference of the slope of between males and females, and age and SES interactions represents the change in the slope at different levels of SES(?).