

county_models_present

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```
#DATA
names(demographics) <- tolower(names(demographics))

model_dt <- turnouts_county_data(turnout_list)

model_dt$dates <- as.factor(model_dt$dates)
model_dt$types <- as.factor(model_dt$types)

model_dt <- filter(model_dt, !is.na(model_dt$reg))

model_dt <- left_join(model_dt, demographics, by = "county")

model_dt$county <- as.factor(model_dt$county)

#MODELS

##MODEL 1

md_1 <- glm(data = model_dt, turnout ~ pct_white + pct_urban + county)

summary(md_1)

##
## Call:
## glm(formula = turnout ~ pct_white + pct_urban + county, data = model_dt)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -0.38095  -0.15980  -0.03896   0.17156   0.56682
##
## Coefficients: (2 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.684609   0.930859   0.735   0.4623
## pct_white      -0.091375   1.004528  -0.091   0.9276
## pct_urban      -0.277328   0.393461  -0.705   0.4812
## countyAlamosa  -0.008657   0.205569  -0.042   0.9664
## countyArapahoe  0.059868   0.108177   0.553   0.5802
## countyArchuleta -0.074504   0.080693  -0.923   0.3562
## countyBaca     -0.038293   0.125250  -0.306   0.7599
## countyBent      0.031705   0.125245   0.253   0.8002
## countyBoulder   0.058465   0.221585   0.264   0.7920
## countyBroomfield 0.118109   0.252452   0.468   0.6401
## countyChaffee    0.096121   0.189179   0.508   0.6116
## countyCheyenne  -0.004180   0.124061  -0.034   0.9731
## countyClear Creek -0.158121   0.117195  -1.349   0.1777
## countyConejos   -0.147084   0.518922  -0.283   0.7769
## countyCostilla  -0.140564   0.626891  -0.224   0.8227
```

## countyCrowley	-0.114716	0.363623	-0.315	0.7525
## countyCuster	0.001746	0.117203	0.015	0.9881
## countyDelta	-0.024595	0.093877	-0.262	0.7934
## countyDenver	-0.002660	0.086058	-0.031	0.9753
## countyDolores	-0.115033	0.117797	-0.977	0.3292
## countyDouglas	0.095437	0.272803	0.350	0.7266
## countyEagle	-0.029321	0.084352	-0.348	0.7283
## countyEl Paso	0.032358	0.153918	0.210	0.8336
## countyElbert	-0.098869	0.117751	-0.840	0.4014
## countyFremont	0.039704	0.169325	0.234	0.8147
## countyGarfield	0.002705	0.083721	0.032	0.9742
## countyGilpin	-0.195298	0.117816	-1.658	0.0979
## countyGrand	-0.096441	0.107068	-0.901	0.3681
## countyGunnison	-0.091462	0.146485	-0.624	0.5326
## countyHinsdale	0.054785	0.117729	0.465	0.6418
## countyHuerfano	0.018049	0.161901	0.111	0.9113
## countyJackson	-0.034279	0.126263	-0.271	0.7861
## countyJefferson	0.094609	0.234286	0.404	0.6865
## countyKiowa	0.007118	0.117766	0.060	0.9518
## countyKit Carson	0.042564	0.080601	0.528	0.5976
## countyLa Plata	-0.108083	0.085798	-1.260	0.2082
## countyLake	-0.044992	0.110657	-0.407	0.6844
## countyLarimer	0.072687	0.260269	0.279	0.7801
## countyLas Animas	-0.006712	0.177205	-0.038	0.9698
## countyLincoln	-0.071115	0.172840	-0.411	0.6809
## countyLogan	0.091242	0.140329	0.650	0.5158
## countyMesa	0.042887	0.243655	0.176	0.8603
## countyMineral	0.016145	0.121265	0.133	0.8941
## countyMoffat	0.007592	0.187606	0.040	0.9677
## countyMontezuma	-0.114966	0.099263	-1.158	0.2472
## countyMontrose	0.016583	0.091876	0.180	0.8568
## countyMorgan	0.016310	0.089452	0.182	0.8554
## countyOtero	-0.001323	0.134714	-0.010	0.9922
## countyOuray	-0.116254	0.117889	-0.986	0.3244
## countyPark	-0.122114	0.117321	-1.041	0.2983
## countyPhillips	-0.119730	0.173567	-0.690	0.4906
## countyPitkin	-0.065013	0.178769	-0.364	0.7162
## countyProwers	-0.008041	0.096114	-0.084	0.9334
## countyPueblo	0.016798	0.096983	0.173	0.8625
## countyRio Blanco	-0.075465	0.130767	-0.577	0.5641
## countyRio Grande	-0.066331	0.247587	-0.268	0.7889
## countyRoutt	-0.028231	0.201408	-0.140	0.8886
## countySaguache	-0.195286	0.377335	-0.518	0.6050
## countySan Juan	-0.163076	0.136682	-1.193	0.2333
## countySan Miguel	-0.217148	0.122666	-1.770	0.0772
## countySedgwick	-0.014318	0.134360	-0.107	0.9152
## countySummit	-0.083251	0.215208	-0.387	0.6990
## countyTeller	-0.061382	0.147748	-0.415	0.6780
## countyWashington	0.009425	0.120239	0.078	0.9375
## countyWeld	NA	NA	NA	NA
## countyYuma	NA	NA	NA	NA
## ---				
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
##				

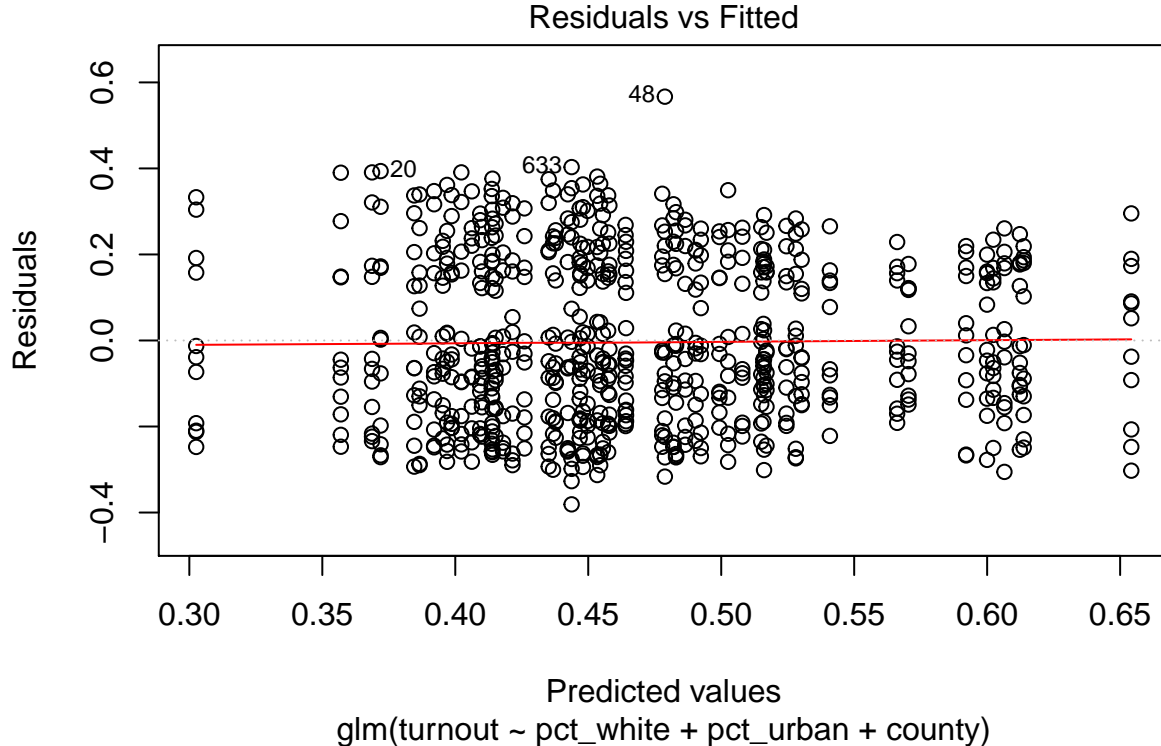
```
## (Dispersion parameter for gaussian family taken to be 0.03975454)
##
## Null deviance: 29.081 on 703 degrees of freedom
## Residual deviance: 25.443 on 640 degrees of freedom
## AIC: -209.65
##
## Number of Fisher Scoring iterations: 2
```

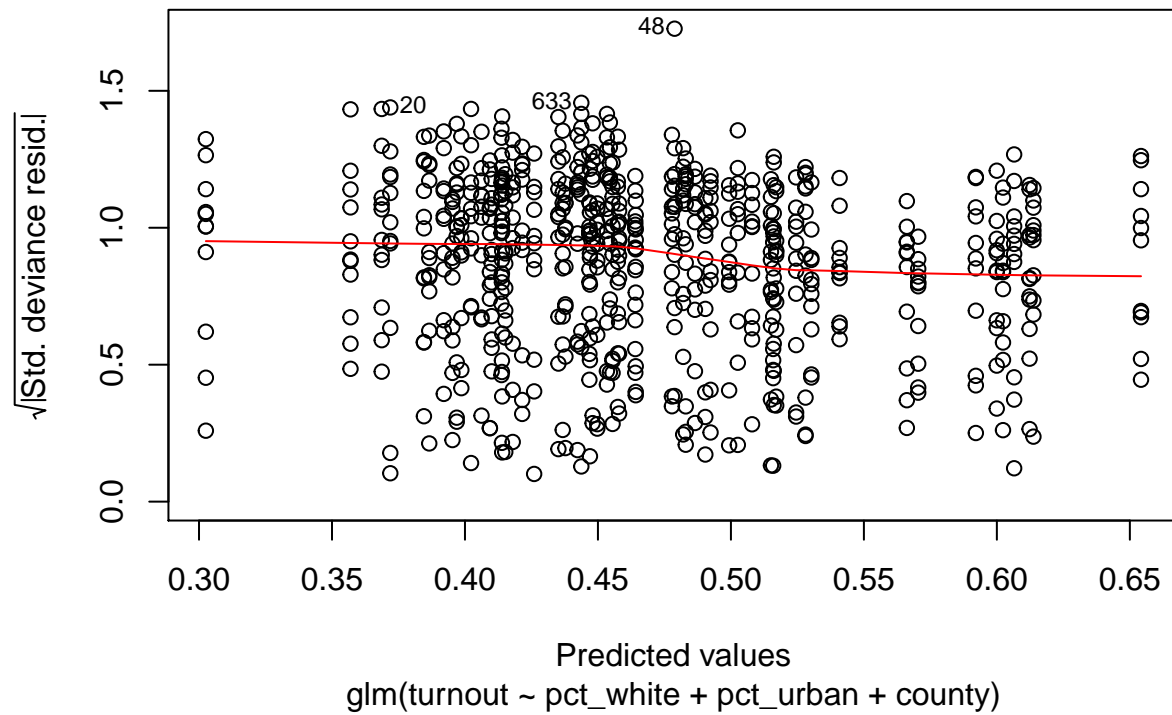
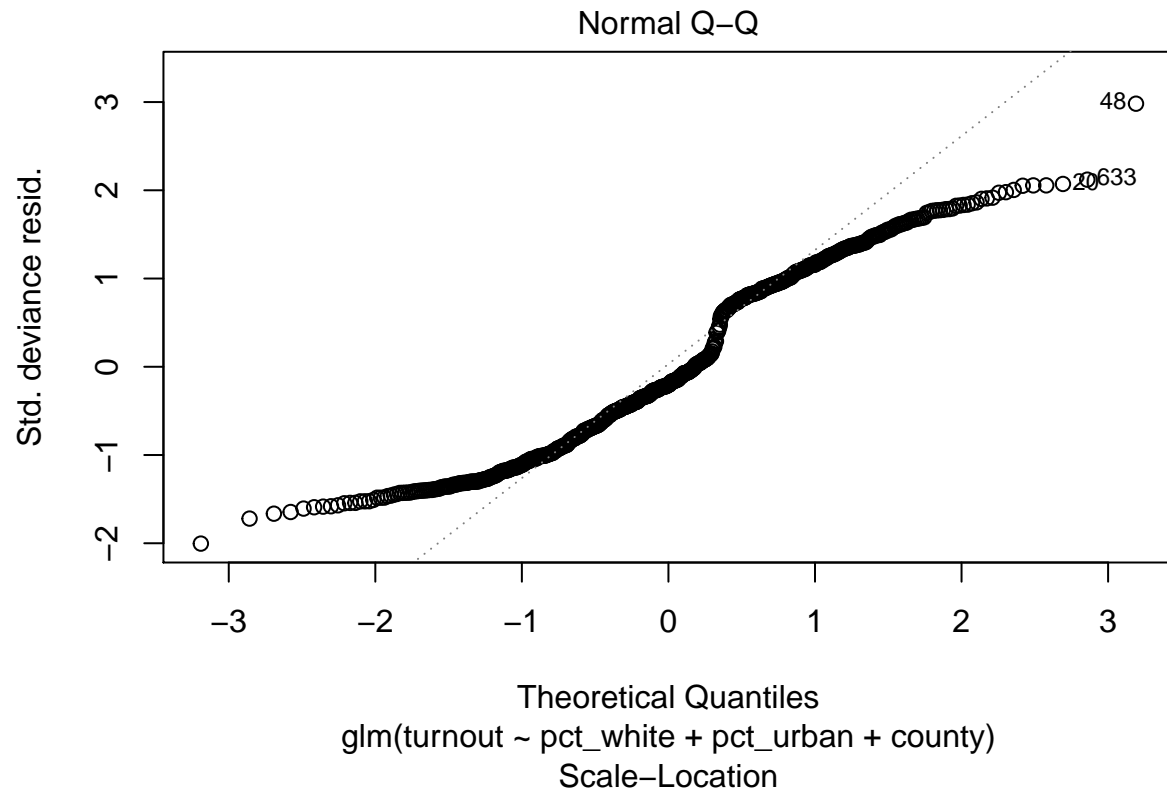
```
alias(md_1)
```

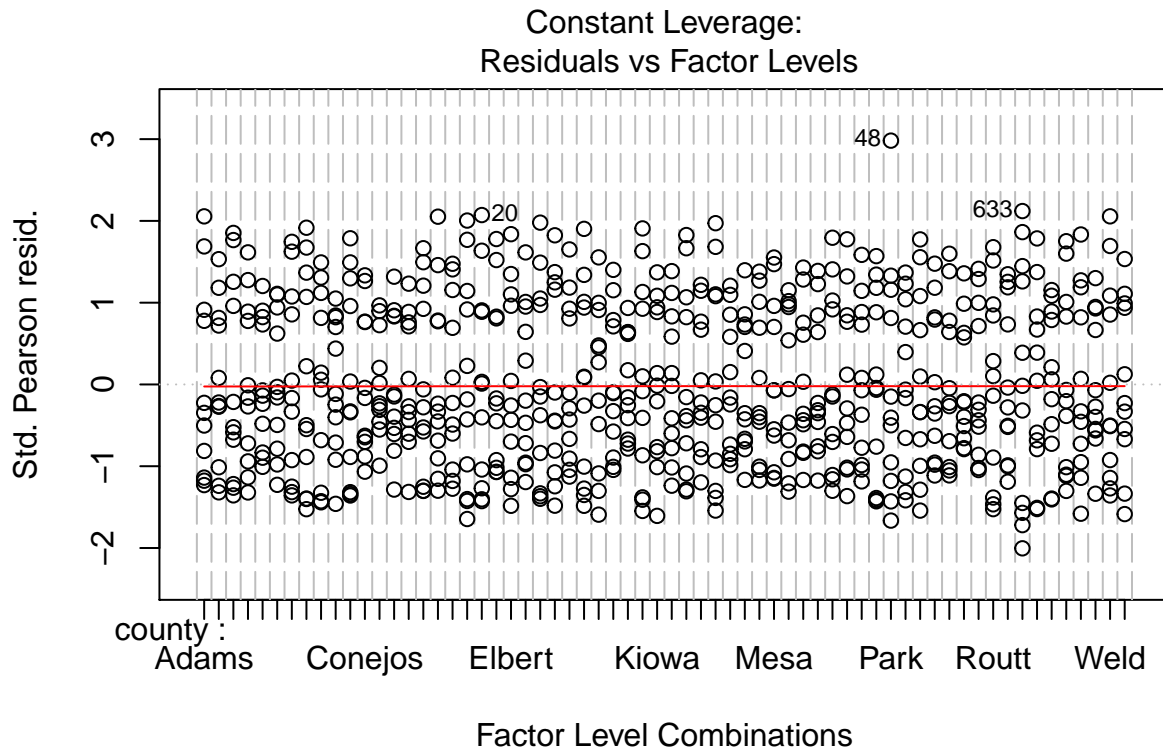
```
## Model :
## turnout ~ pct_white + pct_urban + county
##
## Complete :
##      (Intercept)      pct_white      pct_urban
## countyWeld      -175022/14401      241646/18301      63771/11986
## countyYuma       1096113/223165      -20283/5591      -88025/28456
##      countyAlamosa      countyArapahoe      countyArchuleta
## countyWeld       31771/14184      -1167/814      -19541/59323
## countyYuma      -56607947/48890606      14351/33588      -7077/8639
##      countyBaca      countyBent      countyBoulder
## countyWeld       9313819/16329946      52261/48971      -8690355/2741239
## countyYuma       -30837/17833      -4901944/5743483      6610138/8424127
##      countyBroomfield      countyChaffee      countyCheyenne
## countyWeld       -43345/11988      -41244/15821      3376/6437
## countyYuma       651479/624640      74926/454405      -136609/79581
##      countyClear Creek      countyConejos      countyCostilla
## countyWeld       -3605/410346      17375/2619      819665/101389
## countyYuma       -2116724/1348153      -16175/4764      -285911/75365
##      countyCrowley      countyCuster      countyDelta
## countyWeld       32253/7145      4830023/630240906      -29090/38123
## countyYuma       -663147/235765      -36753/23341      -57121/74964
##      countyDenver      countyDolores      countyDouglas
## countyWeld       -4606/86059      39235/269149      -526300/135883
## countyYuma       2241/30376      -1053/653      7023643/7351665
##      countyEagle      countyEl Paso      countyElbert
## countyWeld       -14025/14252      -537711/244774      61465/439959
## countyYuma       280987/82844472      217117/420068      -43283/26869
##      countyFremont      countyGarfield      countyGilpin
## countyWeld       -844/355      -218255/225898      292350/1971329
## countyYuma       12242/43533      -187971/2734111      -18091/11214
##      countyGrand      countyGunnison      countyHinsdale
## countyWeld       -161087/261786      -177199/97508      -67063/425201
## countyYuma       -24505/21889      -2535865/6373808      -2845411/1860753
##      countyHuerfano      countyJackson      countyJefferson
## countyWeld       49734/30085      4113/6775      -3804/1135
## countyYuma       -7681/5858      -5025679/2889480      883/1018
##      countyKiowa      countyKit Carson      countyLa Plata
## countyWeld       -5906/36301      -49758115/74618496      -18133/30924
## countyYuma       -4205181/2752433      -8254913/14949194      -14456/19073
##      countyLake      countyLarimer      countyLas Animas
## countyWeld       232649/288801      -79018/21369      339345/183248
## countyYuma       -356387/532603      83364/94219      -15272/13693
##      countyLincoln      countyLogan      countyMesa
## countyWeld       13313/8023      -46162729/23811154      -277901/80165
```

```
## countyYuma -91380249/45050111 97/836 72291/89836
## countyMineral countyMoffat countyMontezuma
## countyWeld -790/1881 -2458/933 78785/158916
## countyYuma -628641/431429 88001/261487 -4293/3659
## countyMontrose countyMorgan countyOtero
## countyWeld -7389218/7341891 2003/4772 24295/20184
## countyYuma -5301/13304 -79174/134813 -437845/525624
## countyOuray countyPark countyPhillips
## countyWeld -553/3100 773212/12714297 475971/284617
## countyYuma -2396579/1573081 -857548/539605 -71808/35339
## countyPitkin countyProwers countyPueblo
## countyWeld -19878/8225 121741/215059 6185/13974
## countyYuma 9441/5053207 -80960349/113296186 -12733/43389
## countyRio Blanco countyRio Grande countyRoutt
## countyWeld 181081/240797 43797/15170 -18986/6949
## countyYuma -4567/2567 -293663/167380 479/6596
## countySaguache countySan Juan countySan Miguel
## countyWeld 9140/1943 71941/78708 20982/45061
## countyYuma -174398/60873 -546771/299825 -3179054/1869549
## countySedgwick countySummit countyTeller
## countyWeld 280491/328748 -80291/26312 -845323/470939
## countyYuma -4801/2657 4309/7442 -533/1136
## countyWashington
## countyWeld 6104257/17804938
## countyYuma -5/3
```

```
plot(md_1)
```







```
md_1_cv <- cv.glm(model_dt, md_1, K=5)
```

```
## Warning in predict.lm(object, newdata, se.fit, scale = 1, type =
## ifelse(type == : prediction from a rank-deficient fit may be misleading

## Warning in predict.lm(object, newdata, se.fit, scale = 1, type =
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## ifelse(type == : prediction from a rank-deficient fit may be misleading

## Warning in predict.lm(object, newdata, se.fit, scale = 1, type =
## ifelse(type == : prediction from a rank-deficient fit may be misleading

## Warning in predict.lm(object, newdata, se.fit, scale = 1, type =
## ifelse(type == : prediction from a rank-deficient fit may be misleading
```

```
## ifelse(type == : prediction from a rank-deficient fit may be misleading
md_1_cv$delta
```

```
## [1] 0.04452120 0.04354229
```

```
##MODEL 2
```

```
md_2 <- lmer(data = model_dt, turnout ~ pct_white + pct_urban + (1|county))
```

```
arm::display(md_2)
```

```
## lmer(formula = turnout ~ pct_white + pct_urban + (1 | county),
##       data = model_dt)
##               coef.est coef.se
## (Intercept)   0.49      0.05
## pct_white     0.03      0.05
## pct_urban    -0.12      0.02
##
## Error terms:
## Groups      Name      Std.Dev.
## county      (Intercept) 0.00
## Residual                    0.20
## ---
## number of obs: 704, groups: county, 64
## AIC = -252.9, DIC = -298.7
## deviance = -280.8
```

```
summary(md_2)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: turnout ~ pct_white + pct_urban + (1 | county)
## Data: model_dt
##
## REML criterion at convergence: -262.9
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.3050 -0.8218 -0.1456  0.9135  2.6318
##
## Random effects:
## Groups      Name      Variance Std.Dev.
## county      (Intercept) 7.428e-20 2.725e-10
## Residual                    3.946e-02 1.986e-01
## Number of obs: 704, groups: county, 64
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)   0.49203    0.04510 701.00000  10.909 < 2e-16 ***
## pct_white     0.03365    0.05323 701.00000   0.632  0.528
## pct_urban    -0.11828    0.02188 701.00000 -5.407 8.82e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
```

```
##          (Intr) pct_wh
## pct_white -0.968
## pct_urban -0.503  0.336
```

```
ranef(md_2)
```

```
## $county
##          (Intercept)
## Adams      -5.639479e-19
## Alamosa     4.440962e-19
## Arapahoe    3.486192e-19
## Archuleta   -9.166268e-19
## Baca        9.237483e-19
## Bent        1.074526e-18
## Boulder     1.442052e-19
## Broomfield  1.104455e-18
## Chaffee     1.675729e-18
## Cheyenne    1.621136e-18
## Clear Creek -1.671050e-18
## Conejos     -1.400398e-19
## Costilla    2.792734e-19
## Crowley     1.145014e-19
## Custer      1.642520e-18
## Delta       1.172380e-19
## Denver      -7.110009e-19
## Dolores     -7.485403e-19
## Douglas     8.028805e-19
## Eagle       -9.958168e-19
## El Paso     -2.050538e-19
## Elbert      -4.150185e-19
## Fremont     3.051074e-19
## Garfield    -2.364408e-19
## Gilpin      -2.410078e-18
## Grand       -9.043801e-19
## Gunnison    -1.576786e-18
## Hinsdale    2.708360e-18
## Huerfano    1.315891e-18
## Jackson     1.014080e-18
## Jefferson   8.116924e-19
## Kiowa       1.720338e-18
## Kit Carson  1.200951e-18
## La Plata    -1.649427e-18
## Lake        -7.200193e-19
## Larimer     3.970802e-19
## Las Animas  4.966655e-19
## Lincoln     4.576345e-19
## Logan       1.519890e-18
## Mesa        -1.517905e-19
## Mineral     1.856827e-18
## Moffat      -3.891256e-19
## Montezuma   -1.417010e-18
## Montrose    5.130259e-19
## Morgan      5.070040e-19
## Otero       3.374114e-19
## Ouray       -8.373674e-19
```

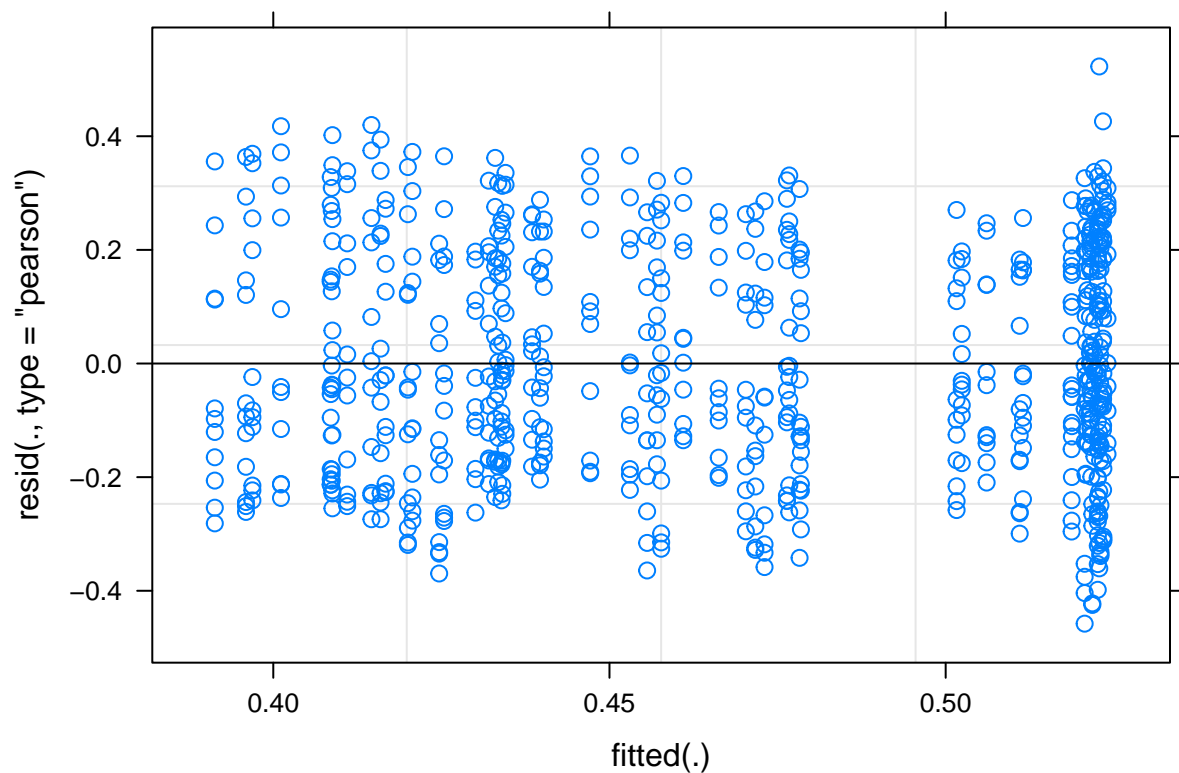


```
## Park      -9.118196e-19
## Phillips  -5.464854e-19
## Pitkin    -1.470787e-18
## Prowers    1.515902e-19
## Pueblo     1.076986e-19
## Rio Blanco 1.896524e-19
## Rio Grande -4.564709e-20
## Routt     -7.490440e-19
## Saguache  -1.516595e-18
## San Juan  -1.592728e-18
## San Miguel -2.800300e-18
## Sedgwick   1.475658e-18
## Summit    -2.528358e-18
## Teller    -8.596100e-19
## Washington 1.867231e-18
## Weld      -3.810774e-19
## Yuma       8.152546e-19
```

```
fixef(md_2)
```

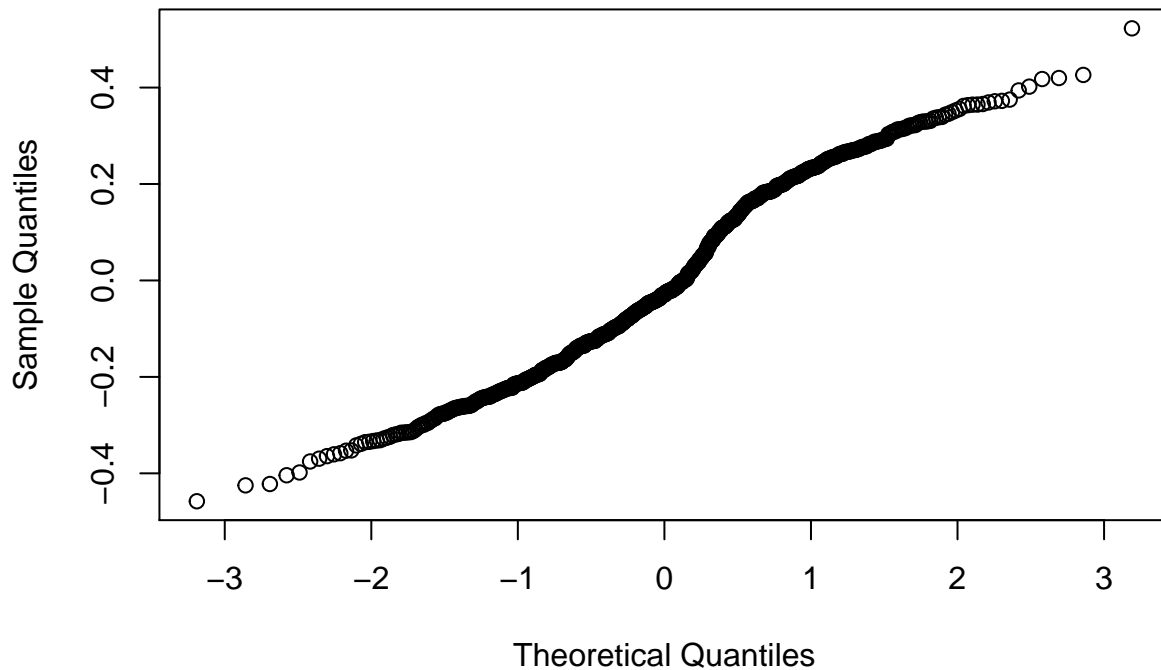
```
## (Intercept)  pct_white  pct_urban
## 0.49202848  0.03364891 -0.11827707
```

```
plot(md_2)
```



```
qqnorm(residuals(md_2))
```

Normal Q-Q Plot



```
##MODEL 3

md_3 <- lmer(data = model_dt, turnout ~ 1 + types + pct_vbm +
             pct_urban + pct_white + pct_vbm*types + (1|county))

arm::display(md_3)

## lmer(formula = turnout ~ 1 + types + pct_vbm + pct_urban + pct_white +
##       pct_vbm * types + (1 | county), data = model_dt)
##               coef.est coef.se
## (Intercept)      0.46    0.08
## typesGeneral      0.19    0.07
## typesMidterm      0.25    0.07
## typesPrimary     -0.07    0.07
## pct_vbm           0.00    0.07
## pct_urban        -0.12    0.02
## pct_white         0.03    0.05
## typesGeneral:pct_vbm 0.15    0.07
## typesMidterm:pct_vbm -0.06    0.07
## typesPrimary:pct_vbm -0.09    0.07
##
## Error terms:
##   Groups   Name      Std.Dev.
##   county  (Intercept) 0.05
##   Residual              0.06
## ---
## number of obs: 704, groups: county, 64
## AIC = -1716.4, DIC = -1866
## deviance = -1803.2
```

```
summary(md_3)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula:
## turnout ~ 1 + types + pct_vbm + pct_urban + pct_white + pct_vbm *
##      types + (1 | county)
##      Data: model_dt
##
## REML criterion at convergence: -1740.4
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.6562 -0.6606 -0.0802  0.5676  4.3284
##
## Random effects:
##   Groups   Name                Variance Std.Dev.
##   county   (Intercept)  0.002992  0.05470
##   Residual                    0.003725  0.06103
## Number of obs: 704, groups:  county, 64
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)    0.455323   0.078735 420.449168   5.783 1.43e-08 ***
## typesGeneral    0.189513   0.070405 646.568238   2.692 0.007291 **
## typesMidterm    0.251514   0.068701 648.003082   3.661 0.000272 ***
## typesPrimary   -0.071025   0.069101 643.013614  -1.028 0.304412
## pct_vbm        -0.001898   0.066976 651.651005  -0.028 0.977397
## pct_urban      -0.116833   0.021088  60.776531  -5.540 6.88e-07 ***
## pct_white       0.032829   0.051294  60.687975   0.640 0.524567
## typesGeneral:pct_vbm  0.152441   0.073724 645.355240   2.068 0.039063 *
## typesMidterm:pct_vbm -0.056684   0.071323 647.009558  -0.795 0.427056
## typesPrimary:pct_vbm -0.087717   0.070528 642.824976  -1.244 0.214055
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) typsGn typsMd typsPr pct_vb pct_rb pct_wh typG:_ typM:_
## typesGenerl -0.774
## typesMidtrm -0.795  0.882
## typesPrimry -0.770  0.858  0.881
## pct_vbm     -0.832  0.923  0.949  0.920
## pct_urban   -0.272 -0.004 -0.004  0.003 -0.007
## pct_white   -0.532  0.000 -0.001 -0.003 -0.003  0.336
## typsGnrl:p_  0.748 -0.992 -0.853 -0.830 -0.896  0.003  0.000
## typsMdtrm:_  0.776 -0.860 -0.992 -0.860 -0.930  0.003  0.000  0.836
## typsPrmry:_  0.765 -0.851 -0.874 -0.996 -0.917 -0.004  0.003  0.828  0.857
```

```
ranef(md_3)
```

```
## $county
##              (Intercept)
## Adams                -2.382243e-02
## Alamosa                1.969410e-02
```

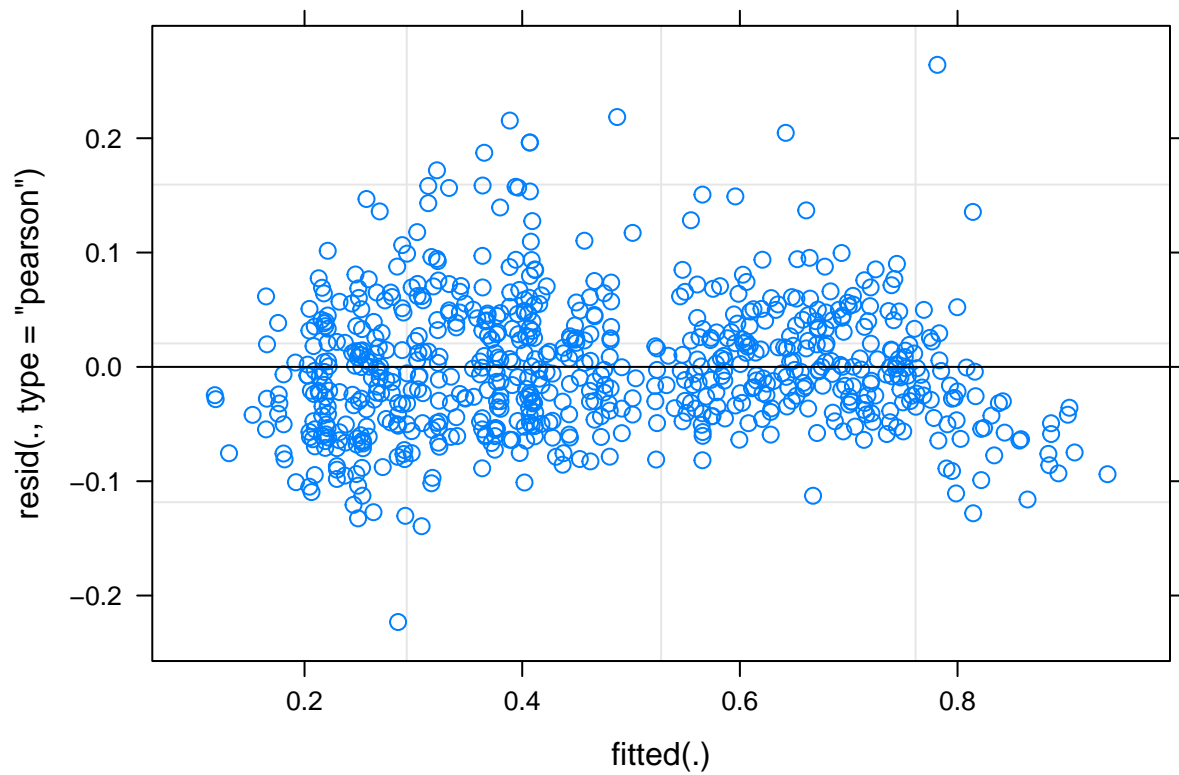
## Arapahoe	1.563754e-02
## Archuleta	-4.076580e-02
## Baca	4.163323e-02
## Bent	4.817540e-02
## Boulder	6.821945e-03
## Broomfield	4.824689e-02
## Chaffee	7.299585e-02
## Cheyenne	7.269259e-02
## Clear Creek	-7.425510e-02
## Conejos	-4.511463e-03
## Costilla	8.871632e-03
## Crowley	7.995174e-03
## Custer	6.592292e-02
## Delta	6.205391e-03
## Denver	-3.033145e-02
## Dolores	-3.033967e-02
## Douglas	3.533863e-02
## Eagle	-4.259044e-02
## El Paso	-9.378466e-03
## Elbert	-1.680383e-02
## Fremont	1.478907e-02
## Garfield	-9.545322e-03
## Gilpin	-1.078281e-01
## Grand	-3.751637e-02
## Gunnison	-6.620471e-02
## Hinsdale	1.118020e-01
## Huerfano	5.869779e-02
## Jackson	4.021378e-02
## Jefferson	3.549839e-02
## Kiowa	7.679425e-02
## Kit Carson	4.774945e-02
## La Plata	-6.971753e-02
## Lake	-3.743398e-02
## Larimer	1.785076e-02
## Las Animas	2.034062e-02
## Lincoln	2.195112e-02
## Logan	6.589940e-02
## Mesa	-6.954947e-03
## Mineral	8.092664e-02
## Moffat	-1.890444e-02
## Montezuma	-5.966571e-02
## Montrose	2.333387e-02
## Morgan	2.283675e-02
## Otero	1.556119e-02
## Ouray	-3.441299e-02
## Park	-4.039314e-02
## Phillips	-2.230239e-02
## Pitkin	-6.950923e-02
## Prowers	4.117000e-03
## Pueblo	5.630350e-03
## Rio Blanco	9.746122e-03
## Rio Grande	8.541873e-05
## Routt	-3.068352e-02
## Saguache	-6.832954e-02

```
## San Juan      -7.344061e-02
## San Miguel   -1.192599e-01
## Sedgwick      6.580142e-02
## Summit       -1.115885e-01
## Teller        -3.725114e-02
## Washington    8.303556e-02
## Weld          -1.645519e-02
## Yuma          3.730376e-02
```

```
fixef(md_3)
```

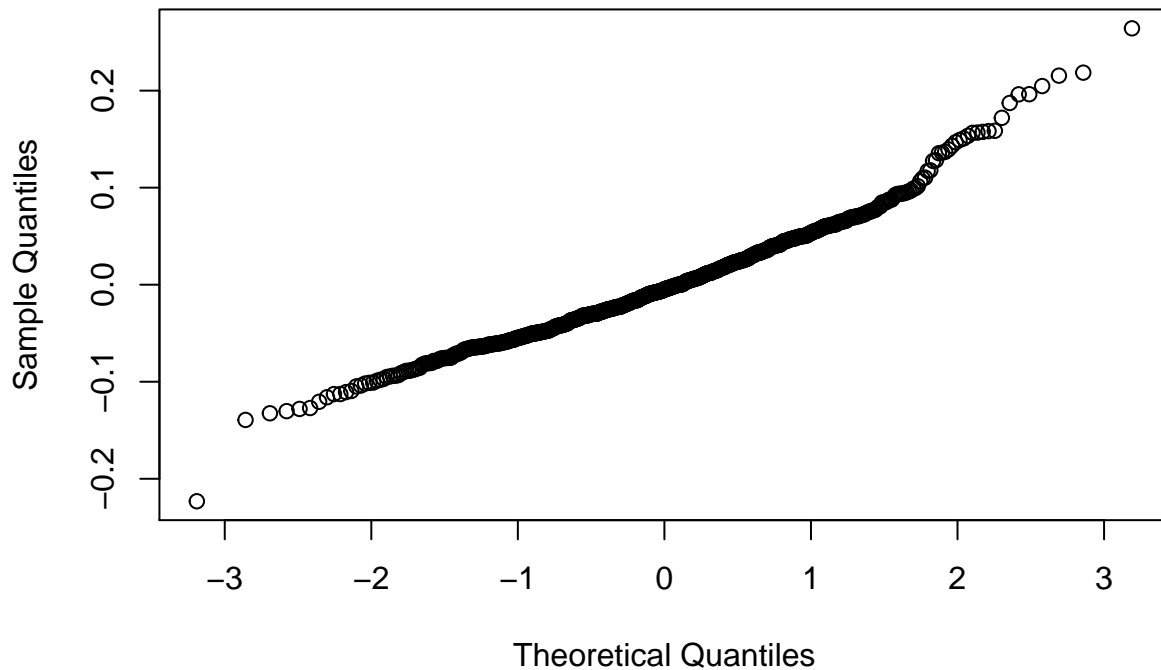
```
##      (Intercept)      typesGeneral      typesMidterm
##      0.45532312      0.18951337      0.25151371
##      typesPrimary      pct_vbm      pct_urban
##      -0.07102476      -0.00189834      -0.11683342
##      pct_white typesGeneral:pct_vbm typesMidterm:pct_vbm
##      0.03282919      0.15244096      -0.05668361
## typesPrimary:pct_vbm
##      -0.08771676
```

```
plot(md_3)
```



```
qqnorm(residuals(md_3))
```

Normal Q-Q Plot



```
#Significant difference by adding extra variables
anova(md_2, md_3)
```

```
## refitting model(s) with ML (instead of REML)

## Data: model_dt
## Models:
## md_2: turnout ~ pct_white + pct_urban + (1 | county)
## md_3: turnout ~ 1 + types + pct_vbm + pct_urban + pct_white + pct_vbm *
## md_3:      types + (1 | county)
##      Df      AIC      BIC logLik deviance  Chisq Chi Df Pr(>Chisq)
## md_2  5 -270.82 -248.03 140.41 -280.82
## md_3 12 -1779.20 -1724.52 901.60 -1803.20 1522.4      7 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##MODEL 4
```

```
model_dt$dates <- as.integer(model_dt$dates)

md_4 <- gamm4(turnout ~ 1 + types + types +
               pct_urban + pct_white + pct_vbm*types + s(dates, k = 7),
               random =~ (1|county),
               data = model_dt)

summary(md_4$mer)
```

```
## Linear mixed model fit by REML ['lmerMod']
##
## REML criterion at convergence: -1899.4
##
```

```

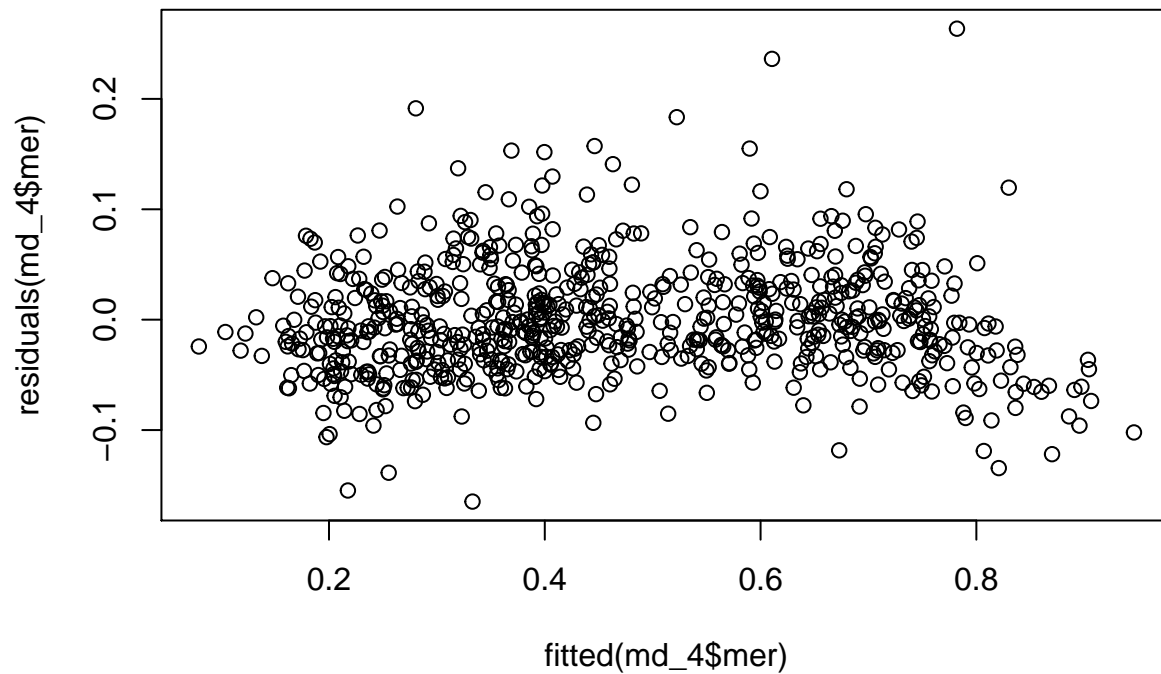
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.1206 -0.6102 -0.1110  0.5546  4.9920
##
## Random effects:
##   Groups   Name                Variance Std.Dev.
##   county   (Intercept)  0.002962  0.05442
##   Xr        s(dates)      0.967661  0.98370
##   Residual                        0.002788  0.05281
## Number of obs: 704, groups:  county, 64; Xr, 5
##
## Fixed effects:
##              Estimate Std. Error t value
## X(Intercept)      0.469534   0.072036   6.518
## XtypesGeneral      0.254063   0.064603   3.933
## XtypesMidterm      0.070291   0.062977   1.116
## XtypesPrimary     -0.170327   0.061898  -2.752
## Xpct_urban        -0.119413   0.020723  -5.762
## Xpct_white         0.031336   0.050401   0.622
## Xpct_vbm           0.002371   0.058353   0.041
## XtypesGeneral:pct_vbm 0.085084   0.067613   1.258
## XtypesMidterm:pct_vbm 0.106871   0.064296   1.662
## XtypesPrimary:pct_vbm -0.005732   0.061585  -0.093
## Xs(dates)Fx1      -0.113090   0.019823  -5.705
##
## Correlation of Fixed Effects:
##              X(Int) XtypsG XtypsM XtypsP Xpct_r Xpct_w Xpct_v XtyG:_ XtyM:_
## XtypesGenrl -0.715
## XtypesMdtrm -0.741  0.822
## XtypesPrmry -0.736  0.833  0.882
## Xpct_urban  -0.292 -0.001  0.000  0.005
## Xpct_white  -0.571  0.001  0.000 -0.002  0.336
## Xpct_vbm    -0.792  0.864  0.887  0.883 -0.008 -0.003
## XtypsGnrl:_  0.661 -0.967 -0.747 -0.764  0.000 -0.002 -0.836
## XtypsMdtr:_  0.705 -0.779 -0.968 -0.833 -0.001 -0.001 -0.880  0.751
## XtypsPrmr:_  0.719 -0.808 -0.846 -0.972 -0.005  0.002 -0.903  0.789  0.846
## Xs(dats)Fx1 -0.015  0.116  0.138  0.107  0.011  0.004  0.013 -0.156 -0.146
##              XtyP:_
## XtypesGenrl
## XtypesMdtrm
## XtypesPrmry
## Xpct_urban
## Xpct_white
## Xpct_vbm
## XtypsGnrl:_
## XtypsMdtr:_
## XtypsPrmr:_
## Xs(dats)Fx1 -0.112

```

```

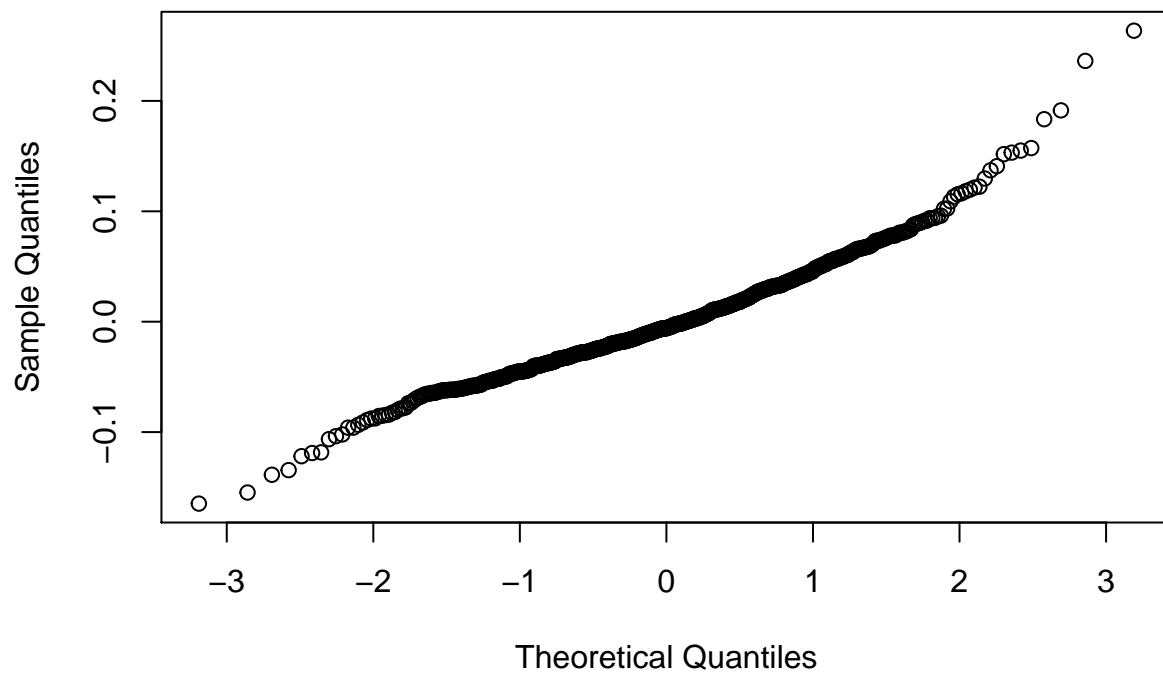
plot(fitted(md_4$mer), residuals(md_4$mer))

```



```
qqnorm(residuals(md_4$mer))
```

Normal Q-Q Plot



CV MSE

```
#Get folds from data
set.seed(1)
folds <- split(sample(nrow(model_dt), nrow(model_dt), replace=FALSE), as.factor(1:5))
```

```
## Warning in split.default(sample(nrow(model_dt), nrow(model_dt), replace =
```



```
## FALSE), : data length is not a multiple of split variable
```

```
#Model 2
```

```
mse <- rep(0,5)
```

```
for(i in 1:5){
```

```
  md_2.fit <- lmer(data = model_dt, subset = -folds[[i]], turnout ~ pct_white + pct_urban + (1|county))
```

```
  mse[i] <- mean((model_dt$turnout - predict(md_2.fit, model_dt))[-folds[[i]]]^2)
```

```
}
```

```
mean(mse)
```

```
## [1] 0.03919217
```

```
#Model 3
```

```
mse <- rep(0,5)
```

```
for(i in 1:5){
```

```
  md_3.fit <- lmer(data = model_dt, subset = -folds[[i]], turnout ~ 1 + types + pct_vbm +  
    pct_urban + pct_white + pct_vbm*types + (1|county))
```

```
  mse[i] <- mean((model_dt$turnout - predict(md_3.fit, model_dt))[-folds[[i]]]^2)
```

```
}
```

```
mean(mse)
```

```
## [1] 0.003297401
```

```
#Model 4
```

```
mse <- rep(0,5)
```

```
model_dt$dates <- as.integer(model_dt$dates)
```

```
for(i in 1:5){
```

```
  md_4.fit <- gamm4(turnout ~ 1 + types + types +  
    pct_urban + pct_white + pct_vbm*types + s(dates, k = 7),  
    random =~ (1|county),  
    data = model_dt, subset = -folds[[i]])
```

```
  mse[i] <- mean((model_dt$turnout - predict(md_4.fit$gam, model_dt))[-folds[[i]]]^2)
```

```
}
```

```
mean(mse)
```

```
## [1] 0.005530785
```